1. (208) Q1-315:

Slide 1

What is the most likely mechanism of failure for the patellar component shown:

1) Fatigue
3) Tension
2) Shear
5) Delamination
4) Compression

Component fracture in a completely polyethylene patellar component is rare. Most patellar component failures involve metal-backed patellar components. Shearing of the fixation pegs from the remainder of the patellar component is a recognized complication of metal-backed patellar components. The same mechanism is responsible for the failure seen.Correct Answer: Shear

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2. (209) Q1-317:

The minimum thickness of polyethylene required for the tibial component of a total knee prosthesis is:

1) 4 mm
3) 8 mm
2) 6 mm
5) 12 mm
4) 10 mm

Laboratory studies have demonstrated that a minimum of 12 mm polyethylene thickness is required to minimize cold extrusion. However, placement of a 12-mm polyethylene component would necessitate removal of an excessive amount of host bone. Currently, the U.S. Food and Drug Administration requires use of at least 8 mm polyethylene thickness in total knee arthroplasty.Correct Answer: 8 mm

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3. (210) Q1-318:

A 65-year-old man undergoes total knee revision without complication. Routine intraoperative cultures are submitted that are positive for growth of coagulase negative staphylococcus at 48 hours postoperative in 3 of 5 specimens. The patient is afebrile and his wound is dry. Appropriate treatment should include:

1) No further antibiotic therapy
3) Irrigation and debridement with retention of the components
2) Six weeks of parenteral antibiotics
5) Irrigation and debridement with removal of components and delayed exchange arthroplasty
4) Irrigation and debridement with one stage component exchange

Infected total knee arthroplasties can be placed into one of the following categories:

- Positive intraoperative cultures without gross evidence of infection
- Early postoperative infection
- Late chronic infection
- Acute hematogenous infection

Patients with positive intraoperative cultures can only be treated with 6 weeks of antibiotics. Early postoperative infections are treated with multiple debridements as indicated with retention of the prosthesis and antibiotic therapy. Late chronic infections are treated with component removal and delayed exchange arthroplasty. If treated early enough, acute hematogenous infections can be treated with irrigation and debridement with prosthetic retention.

Correct Answer: Six weeks of parenteral antibiotics

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4. (211) Q1-319:

When preoperatively templating a radiograph in preparation for the femoral component in total hip arthroplasty, the leg should be positioned in:

1) Neutral rotation
3) 30Â° internal rotation
2) 15Â° internal rotation
5) 30Â° external rotation
4) 15Â° external rotation

When templating the femoral component in total hip arthroplasty, positioning the leg in 15Â° internal rotation neutralizes the femoral anteversion. This gives a true anterior/posterior view of the proximal femur and allows for a more accurate templating of the femoral component.Correct Answer: 15Â° internal rotation

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5. (212) Q1-320:

The most common complication following high tibial osteotomy for treatment of medial compartment knee arthrosis is:

1) Neurovascular injury
3) Undercorrection
2) Overcorrection
5) Patella baja
4) Compartment syndrome

Complications in high tibial osteotomy include undercorrection, overcorrection, osteonecrosis of the tibial plateau, patella baja, neurovascular injury, anterior compartment syndrome, and other complications common to all procedures. The most common of these is undercorrection.Correct Answer: Undercorrection

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6. (213) Q1-321:

Which of the following is considered a contraindication to high tibial osteotomy for the treatment of medial compartment knee arthrosis:

1) 10Â° fixed varus deformity
3) Prior knee infection
2) Normal lateral compartment
5) 5Â° flexion contracture
4) Lateral tibial subluxation of 2 cm

High tibial valgus producing osteotomy attempts to redirect the forces crossing the knee joint from the medial compartment to slightly lateral to the center of the knee. Indications include isolated medial knee pain, less than 15Â° fixed varus deformity, a normal lateral compartment, and a normal patellofemoral compartment. Contraindications include:

- Restricted knee motion (flexion contracture greater than 15Â° or flexion limited to less than 90Â°)
- Lateral tibial subluxation greater than 1 cm
- Peripheral vascular disease
- Tibial bone loss
- Lateral thrust gait pattern

Correct Answer: Lateral tibial subluxation of 2 cm

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7. (231) Q1-341:

Following acute traumatic patellar dislocation, the most important injured structure in regard to future instability of the patellofemoral joint is the:

1) Medial parapateller retinaculum
3) Medial patellofemoral ligament
2) Vastus medialis obliquis
5) Medial patellomeniscal ligament
4) Medial patellotibial ligament

The medial patellofemoral ligament is the primary restraint to lateral subluxation of the patella. The other structures above contribute less substantially to patellofemoral stability. In the majority of cases of acute traumatic patellar dislocation, the medial patellofemoral ligament is disrupted.Correct Answer: Medial patellofemoral ligament

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8. (233) Q1-344:

The most common sequelae following traumatic shoulder dislocation in an 18-year-old man is:

1) Normal shoulder without further problems
3) Axillary nerve injury
2) Recurrent shoulder dislocation
5) Adhesive capsulitis
4) Rotator cuff tear

Up to 90% of young patients with a traumatic shoulder dislocation will have a recurrent dislocation. Rotator cuff tears occur commonly with shoulder dislocation in the older population, but are relatively uncommon in younger patients.Correct Answer: Recurrent shoulder dislocation

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9. (524) Q1-726:

A 55-year-old woman has rheumatoid arthritis with shoulder, elbow, and hand/wrist symptoms. No single site of involvement is more symptomatic than the others. After failure of nonoperative treatment, the appropriate order of surgical intervention is:

1) Hand/wrist, elbow, shoulder
3) Elbow, shoulder, hand/wrist
2) Shoulder, elbow, hand/wrist
5) Shoulder, hand/wrist, elbow
4) Hand/wrist, shoulder, elbow

Generally speaking, the more symptomatic joints are addressed first in rheumatoid arthritis. However, when upper extremity joints are equally disabling, the hand and wrist disability is addressed first. Although it is somewhat controversial, it is generally agreed that the shoulder should be addressed before the elbow. This eliminates referred pain from the shoulder to the elbow, allowing for better evaluation of elbow symptoms. Addressing the shoulder pathology earlier may prevent ensuing rotator cuff tears that can compromise results of arthroplasty. Lastly, increasing shoulder mobility may decrease the stresses on an arthritic elbow.Correct Answer: Hand/wrist, shoulder, elbow

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10. (533) Q1-735:

The normal version of the glenoid is:

1) 20Âº to 30Â° retroversion
3) Neutral to 10Â° retroversion
2) 10Â° to 20Â° retroversion
5) 10Â° to 20Â° anteversion
4) Neutral to 10Â° anteversion

The normal version of the glenoid has been established to be between neutral and 10Â° of retroversion. Excessive glenoid retroversion can indicate excessive posterior wear caused by primary osteoarthritis. Retroversion in excess of 25Â° can indicate glenoid dysplasia.Correct Answer: Neutral to 10Â° retroversion

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11. (534) Q1-736:

Posterior translation of the humeral head is associated with which of the following arthritic etiologies:

1) Primary osteoarthritis
3) Post-infectious arthritis
2) Rheumatoid arthritis
5) Post-traumatic arthritis
4) Arthritis secondary to osteonecrosis

Primary osteoarthritis of the shoulder is a well-described entity. Neer described posterior subluxation of the humeral head following posterior glenoid erosion. Although the exact sequence of events has recently come into question, the end result is a static posterior subluxation of the humeral head with arthritis.Correct Answer: Primary osteoarthritis

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12. (535) Q1-737:

Which of the following statements best describes the most common scenario in regard to the rotator cuff in patients with primary osteoarthritis of the shoulder:

1) Intact rotator cuff
3) Rupture of the supraspinatus tendon only
2) Thin, attenuated rotator cuff
5) Massive rupture of the rotator cuff
4) Rupture of the subscapularis tendon only

In most situations of primary osteoarthritis, the rotator cuff is intact or has minimal tearing.Correct Answer: Intact rotator cuff

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13. (536) Q1-738:

When performing total shoulder arthroplasty, a subscapularis tenotomy is performed as part of the surgical exposure. The following anatomic landmark provides the greatest information regarding the point of initiation of the subscapularis tenotomy:

1) Pectoralis major tendon
3) Deltoid insertion on the humerus
2) Pectoralis minor tendon
5) Anterolateral aspect of the acromion
4) Biceps tendon

It is important to identify the superior aspect of the subscapularis tendon prior to performing subscapularis tenotomy in the surgical exposure for shoulder arthroplasty. With an intact rotator cuff, identification of the superior aspect of the subscapularis tendon at the rotator interval can be difficult. If the biceps tendon is located just medial to the humeral insertion of the pectoralis major and followed superior, the rotator interval can be located and opened, allowing visualization of the superior aspect of the subscapularis tendon. In the event that the biceps tendon is ruptured or dislocated, the base of the coracoid process can be used to identify the medial aspect of the rotator interval.Correct Answer: Biceps tendon

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14. (537) Q1-739:

All of the following are involved in rotator cuff tear arthropathy except:

1) Osteonecrosis
3) Rupture of the rotator cuff
2) Chondrolysis
5) Acromiohumeral arthritis
4) Hydroxyapatite crystal deposition

Cuff tear arthropathy includes osteonecrosis and acromiohumeral arthritis with a rotator cuff tear. Other investigators discovered hydroxyapatite crystal deposition as well. Chondrolysis is not a part of rotator cuff tear arthropathy, but can occur if the individual develops secondary osteoarthritis.Correct Answer: Chondrolysis

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15. (538) Q1-740:

The outcome of patients with osteoarthritis of the shoulder is better after total shoulder arthroplasty compared to humeral arthroplasty with regard to:

1) Strength
3) Active forward elevation
2) Pain relief
5) Ability to sleep
4) Active external rotation

In his prospective study of 51 shoulder arthroplasties, Gartsman found that pain relief and internal rotation were significantly better in patients that had undergone glenoid resurfacing compared to hemiarthroplasty. Patient satisfaction, function, and strength were also higher, but these differences were not statistically different.Correct Answer: Pain relief

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16. (539) Q1-741:

The outcome of patients with rheumatoid arthritis of the shoulder and an intact rotator cuff is better after total shoulder arthroplasty compared to humeral arthroplasty with regard to:

1) Strength
3) Active forward elevation
2) Pain relief
5) Ability to sleep
4) Active external rotation

Provided the rotator cuff is intact, glenoid resurfacing is preferred in patients with rheumatoid arthritis of the shoulder because of better pain relief than isolated humeral arthroplasty.Correct Answer: Pain relief

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17. (540) Q1-742:

Which of the following is most closely associated with glenoid loosening following total shoulder arthroplasty?

1) Dysfunction of the rotator cuff
3) Osteoarthritis
2) Rheumatoid arthritis
5) Osteonecrosis
4) Chondrocalcinosis

Although glenoid loosening occurs more frequently in patients with rheumatoid arthritis than osteoarthritis, this loosening occurs secondary to the dysfunction of the rotator cuff. Similarly, osteoarthritic patients may suffer from the same type of glenoid loosening in the absence of a functioning rotator cuff. Eccentric loading caused by the cuff deficiency can lead to progressive loosening and a "rocking horse glenoid."Correct Answer: Dysfunction of the rotator cuff

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18. (541) Q1-743:

All of the following are considered contraindications to glenoid resurfacing during shoulder arthroplasty except:

1) Dysfunctional deltoid
3) Prior infection
2) Dysfunctional rotator cuff
5) Patient age < 50 years
4) Inadequate glenoid bone stock

While glenoid loosening rates are higher in younger patients, this does not preclude glenoid resurfacing in all cases. The remaining choices are all contraindications to glenoid resurfacing.Correct Answer: Patient age < 50 years

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19. (542) Q1-744:

The anatomical neck to humeral shaft angle averages:

1) 30Â° to 35Â°
3) 40Â° to 45Â°
2) 35Â° to 40Â°
5) 50Â° to 55Â°
4) 45Â° to 50Â°

The average neck-shaft angle in the humerus is 40Â° to 45Â°; however, a large range has been reported (30Â° to 55Â°). This variability has led to the anatomical concept of prosthetic adaptability pioneered by Walch.[1]Correct Answer: 40Â° to 45Â°

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20. (570) Q1-792:

An absolute contraindication to glenoid resurfacing when performing shoulder arthroplasty is:

1) Patient $\leq$50 years of age
3) Insufficient bone stock
2) Presence of a small supraspinatus tear
5) Presence of an inflammatory arthropathy
4) Presence of osteonecrosis of the humeral head

Sufficient bone stock must be present to implant a glenoid component when performing shoulder arthroplasty. While hemiarthroplasty in a young patient without arthritic changes of the glenoid can be considered, age is not considered an absolute contraindication to glenoid resurfacing. While the presence of a large rotator cuff tear represents a contraindication to glenoid resurfacing because of the "rocking horse" effect, which results in glenoid loosening, a small reparable rotator cuff tear does not prohibit resurfacing. Glenoid resurfacing is not contraindicated in osteonecrosis or rheumatoid arthritis provided there is a competent rotator cuff.Correct Answer: Insufficient bone stock

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21. (571) Q1-796:

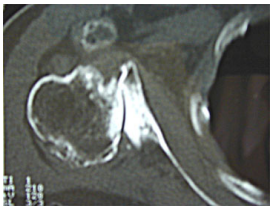

Figure 1

The glenoid morphology depicted in the slide is most often associated with the following etiology:

1) Primary osteoarthritis
3) Osteonecrosis
2) Rheumatoid arthritis
5) Post-infectious arthritis
4) Post-traumatic arthritis

The slide depicts a type B2 biconcave glenoid as classified by Walch secondary to primary OA.

Correct Answer: Primary osteoarthritis

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22. (572) Q1-799:

Positioning of the humeral stem at the time of total shoulder arthroplasty should allow congruent articulation with the glenoid component. Congruent articulation occurs in most shoulders with a humeral stem positionedin:

1) Neutral version
3) 20Â° to 30Â° of retroversion
2) 10Â° to 20Â° of retroversion
5) 20Â° to 30Â° of anteversion
4) 10Â° to 20Â° of anteversion

It is important to place the humeral stem in appropriate version to "mate" with the glenoid component. This is most often represented by 20Â° to 30Â° of humeral retroversion.Correct Answer: 20Â° to 30Â° of retroversion

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23. (573) Q1-801:

Posterior translation of the humeral head is associated with which of the following arthritic etiologies:

1) Primary osteoarthritis
3) Post-infectious arthritis
2) Rheumatoid arthritis
5) Post-traumatic arthritis
4) Arthritis secondary to osteonecrosis

Primary osteoarthritis of the shoulder is a well-described entity. Neer described posterior subluxation of the humeral head following posterior glenoid erosion.[1] Although the exact sequence of events has recently come into question, the end result is a static posterior subluxation of the humeral head with arthritis.Correct Answer: Primary osteoarthritis

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24. (574) Q1-804:

All of the following are involved in rotator cuff tear arthropathy except:

1) Osteonecrosis
3) Rupture of the rotator cuff
2) Chondrolysis
5) Acromiohumeral arthritis
4) Hydroxyapatite crystal deposition

Cuff tear arthropathy includes osteonecrosis and acromiohumeral arthritis with a rotator cuff tear. Other investigators discovered hydroxyapatite crystal deposition as well. Chondrolysis is not a part of rotator cuff tear arthropathy, but can occur if the individual develops secondary osteoarthritis.Correct Answer: Chondrolysis

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25. (575) Q1-806:

The outcome of patients with rheumatoid arthritis of the shoulder and an intact rotator cuff is better after total shoulder arthroplasty compared to humeral arthroplasty with regard to:

1) Strength
3) Active forward elevation
2) Pain relief
5) Ability to sleep
4) Active external rotation

Provided the rotator cuff is intact, glenoid resurfacing is preferred in patients with rheumatoid arthritis of the shoulder because of better pain relief than isolated humeral arthroplasty.Correct Answer: Pain relief

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26. (576) Q1-808:

All of the following are considered contraindications to glenoid resurfacing during shoulder arthroplasty except:

1) Dysfunctional deltoid
3) Prior infection
2) Dysfunctional rotator cuff
5) Patient age <50 years
4) Inadequate glenoid bone stock

While glenoid loosening rates are higher in younger patients, this does not preclude glenoid resurfacing in all cases. The remaining choices are all contraindications to glenoid resurfacing.Correct Answer: Patient age <50 years

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27. (577) Q1-810:

Figure 1

This slide is the radiograph of a 70-year-old man with unremitting shoulder pain despite nonoperative interventions. Recommended treatment includes:

1) Administration of narcotic pain medications
3) Open rotator cuff repair
2) Arthroscopic rotator cuff repair
5) Total shoulder arthroplasty
4) Humeral head arthroplasty

The radiograph demonstrates arthropathy in the presence of rotator cuff deficiency (as indicated by upward migration of the humeral head). The patient has already failed reasonable medical treatment and surgical intervention is warranted. The presence of significant arthrosis with upward migration of the humeral head combined with the patientâs age precludes consideration of rotator cuff repair, although debridement could be considered. Total shoulder arthroplasty is contraindicated because the deficient cuff would almost certainly result in glenoid loosening from eccentric loading. Humeral head arthroplasty would provide some pain relief with limited return of function, and at this time, is the best surgical option for this patient.Correct Answer: Humeral head arthroplasty

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28. (578) Q1-811:

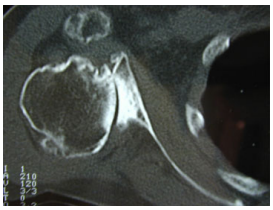

Figure 1

The goal in performing glenoid resurfacing during total shoulder arthroplasty for the patient whose computed tomogram is shown in this slide should be:

1) Placement of the glenoid component in situ
3) Placement of the glenoid component in neutral to 10Â° of retroversion
2) Placement of the glenoid component in neutral to 10Â° of anteversion
5) Placement of the glenoid component in excess of 20Â° of retroversion
4) Placement of the glenoid component in 10Â° to 20Â° of retroversion

The computed tomogram depicts a type B2 glenoid with excessive posterior wear resulting in biconcavity and excessive glenoid retroversion. The goal of glenoid arthroplasty should be to reestablish normal glenoid retroversion between neutral and 10Â°. This may be done with reaming or, in severe cases, may necessitate the use of a posterior bone graft. Implanting the glenoid component in excessive retroversion may result in postoperative instability.Correct Answer: Placement of the glenoid component in neutral to 10Â° of retroversion

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29. (579) Q1-812:

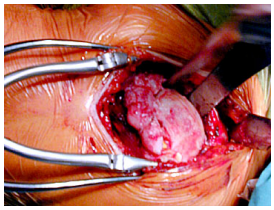

Figure 1

This slide is an intraoperative photograph during total shoulder arthroplasty. The findings in this slide most likely represent which of thefollowing diagnoses:

1) Primary osteoarthritis
3) Rheumatoid arthritis
2) Rotator cuff tear arthropathy
5) Postinfectious arthropathy
4) Osteonecrosis

The large amount of crown osteophytes present in this slide suggest a diagnosis of primary osteoarthritis. It is necessary to remove these osteophytes in order to identify the anatomical neck of the humerus and make the correct humeral head resection.Correct Answer: Primary osteoarthritis

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30. (580) Q1-813:

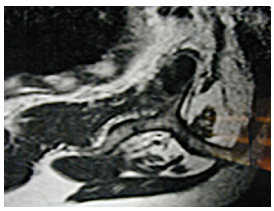

Figure 1

This slide shows a magnetic resonance image from a patient with shoulder pain. Based on the findings of this image, the following procedure is contraindicated:

1) Subacromial corticosteroid injection
3) Shoulder arthrodesis
2) Arthroscopic debridement of the rotator cuff
5) Unconstrained total shoulder arthroplasty
4) Humeral head arthroplasty

The magnetic resonance image depicts near complete fatty infiltration of the supraspinatus muscle and, more importantly, the infraspinatus muscle. Initially, fatty degeneration of the cuff musculature was described as a poor prognostic indicator for rotator cuff function using computed tomography. These observations were also applied to magnetic resonance imaging. Walch advises against performing unconstrained total shoulder arthroplasty in patients with a dysfunctional cuff as indicated by fatty degeneration of the infraspinatus because of poorer results regarding pain relief and active mobility.[1] Furthermore, this degeneration can lead to early glenoid loosening from eccentric loading.Correct Answer: Unconstrained total shoulder arthroplasty

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31. (662) Q1-914:

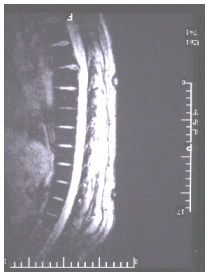

Figure A **Figure B**

A 42-year-old male has a history of 6 months of pain in the lower thoracic region. Recently, the patient developed weakness in the right lower extremity, bladder and bowel movement. Plain x-rays were normal, but an magnetic resonance imaging (MRI) showed a posterolateral thoracic disk herniation at the level of T10-T11 (Slides 1 and 2). Which of the following is the best suggested treatment?

1) Bed rest
3) Laminectomy and decompression
2) Thoraco-lumbar orthosis
5) Thoracotomy, vertebractomy, strut graft and internal fixation
4) Diskectomy through thoracotomy or costotransverectomy

Conservative treatment should be considered for patients without major neurologic deficits. Posterior laminectomy and decompression provides inadequate exposure of the herniated Disk. Vertebractomy, strut bone graft and instrumentation are not necessary. Thoracotomy and costotransversectomy are commonly used for disk herniations at the levels of T4-T12.Correct Answer: Diskectomy through thoracotomy or costotransverectomy

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32. (663) Q1-915:

The patient was diagnosed with spinal stenosis of the lumbosacral spine. In addition to educating the patient about his condition, the most appropriate initial treatment is:

1) Walking program
3) Lumbar traction
2) Nonsteroidal anti-inflammatory drugs
5) Cortisone administration
4) Spinal decompression and fusion

Initial treatment begins with patient education, a physical therapy regime (gentle conditioning exercises), judicious activity change, and sometimes spinal support with a corset or light-weight brace. Anti-inflammatory nonsteroidal drugs provide some relief of symptoms for many patients.Correct Answer: Nonsteroidal anti-inflammatory drugs

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33. (664) Q1-916:

The patient's clinical diagnosis is degenerative spondylolithesis. In what patient population is this condition most commonly symptomatic?

1) Pre-teen males
3) Males over 70 years old
2) Females 40 to 70 years old
5) Males 20 to 30 years old
4) Females 20 to 30 years old

Degenerative spondylolithesis is most frequently symptomatic in the 40 to 70 year old range and is six times more common in females than in males. This population appears to have enough disk degeneration and motion to become symptomatic whereas the older population tend to have aquired enough ankylosis at the level to prevent instability symptoms.Correct Answer: Females 40 to 70 years old

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34. (665) Q1-918:

The biceps electromyographic activity is greatest during which of the following elbow motions:

1) Elbow extension from 90Â° of flexion
3) Elbow supination at 45Â° of flexion
2) Elbow supination at 90Â° of flexion
5) Flexion from 90Â° in pronation
4) Flexion from 90Â° in supination

Electromyographic activity of the biceps is greatest from flexion at 90Â° in supination indicating that this arc of motion is where there is the most sustained contraction of the biceps muscle.Correct Answer: Flexion from 90Â° in supination

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35. (666) Q1-919:

Which of the following is not an appropriate method of treating an elbow joint contracture that has been present for less than 1 year:

1) Closed manipulation
3) Static adjustable splinting (turnbuckle splint)
2) Local heat
5) Active gentle-assisted stretch
4) Dynamic hinged elbow splint

The least appropriate treatment for elbow joint contracture is closed manipulation. The elbow is a sensitive joint, and strenous closed manipulation leads to more bone formation or even possible fracture. The other less drastic measures are more appropriate treatment methods.Correct Answer: Closed manipulation

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36. (667) Q1-920:

The principle complication of constrained and semiconstrained total elbow arthroplasty is:

1) Heterotopic bone formation
3) Loosening of the ulnar component
2) Elbow subluxation and instability
5) Loosening of the humeral component
4) Stress shielding in the humerus

Ulnar component loosening is the most common complication of total elbow arthroplasty. Although other complications also occur, they are less common.Correct Answer: Loosening of the ulnar component

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37. (668) Q1-921:

The best method for testing the integrity of the anterior oblique band of the medial collateral ligament is:

1) Valgus stress in 30Â° of flexion and full supination
3) Varus stress in 30Â° of flexion and slight pronation
2) Valgus stress in 60Â° of flexion and neutral rotation
5) Varus stress in full extension and full pronation
4) Valgus stress in 30Â° of flexion and full pronation

The anterior oblique band of the medial collateral ligament is best tested by valgus stress when the elbow is at 30Â° of flexion and full pronation.Correct Answer: Valgus stress in 30Â° of flexion and full pronation

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38. (672) Q1-926:

Which tendon transfer results in the greatest recovery of thumb-index finger pinch function?

1) Flexor digitorum superficials of ring finger
3) Extensor digitorum communis
2) Extensor indicis proprius
5) Flexor digitorum superficials of middle finger
4) Extensor carpi radialis brevus

The extensor carpi radialis brevus or extensor carpi radialis longus transfer gives the greatest return of power pinch due to the strength of the wrist motors. This should also be coupled with a thumb MP arthrodesis to provide best results.Correct Answer: Extensor carpi radialis brevus

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39. (720) Q1-981:

Which of the following terms is used to describe a localized conduction block in a peripheral nerve in which the axon is disrupted with the intact endoneurial tube:

1) First-degree injury (neuropraxia)
3) Third-degree
2) Second-degree (axonotmesis)
5) Fifth-degree
4) Fourth-degree

- First-degree: Neuropraxia, the nerve structure is intact, full recovery is expected
- Second-degree: Axonotmesis, severance of the axon leading to Wallerian degeneration, continuity of endoneurial sheath is maintained, repair is orderly, complete motor and sensory loss with denervation and fibrillation potentials
- Third-degree: Injury to axons and the endoneurial tube, arrangement of individual fascicles is maintained (perineurium intact), recovery is variable
- Fourth-degree: Injury to axons, endoneurial tube, fascicles with the nerve trunk being intact, Wallerian degeneration and a higher incidence of proximal nerve cell body degeneration, repair is unlikely and surgical repair of the nerve is necessary (excision and grafting)
- Fifth-degree: Loss of nerve trunk continuity, neuroma formation in the proximal stump, wallerian degeneration distally

Correct Answer: Second-degree (axonotmesis)

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40. (967) Q1-1270:

When a patient has his or her hip flexed, which nerve can be palpated at the midpoint between the ischial tuberosity and the greater trochanter:

1) Obturator nerve
3) Peroneal nerve
2) Femoral nerve
5) No nerve typically exists in that region
4) Sciatic nerve

The sciatic nerve is in the posterior compartment of the thigh and can be palpated at the midpoint between the ischial tuberosity and the greater trochanter when the hip is flexed.

- The obturator nerve is in the medial compartment of the thigh.
- The femoral nerve is in the anterior compartment of the thigh.
- The peroneal (common peroneal) nerve bifurcates into the deep peroneal and the superficial peroneal nerves which lie in the anterior and lateral compartments of the leg, respectively.

Correct Answer: Sciatic nerve

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41. (999) Q1-1306:

The principal thrombogenic stimulus leading to the production of venous thromboembolic disease during total hip arthroplasty occurs at which time:

1) During induction of anesthesia
3) 12 hours postoperative
2) During and after preparation of femoral canal
5) 7 days postoperative
4) 24 hours postoperative

Evidence has shown that the process of thrombosis does not begin with the start of the procedure, rather, it is delayed until preparation of the femoral canal. Elevation in thrombogenic factors is most pronounced during preparation of the femoral canal and especially with insertion of a cemented femoral component. Mechanical manipulation of the limb (dislocation of the femoral head) may also cause intimal damage or occlusion of the femoral vein.Correct Answer: During and after preparation of femoral canal

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42. (1000) Q1-1307:

Place the following in the correct order of increasing modulus of elasticity (from least to greatest):

1) Cobalt-chrome, titanium, compact bone, stainless steel
3) Compact bone, titanium, cobalt-chrome, stainless steel
2) Titanium, compact bone, cobalt-chrome, stainless steel
5) Titanium, compact bone, stainless steel, cobalt-chrome
4) Compact bone, titanium, stainless steel, cobalt-chrome

The correct order of modulus of elasticity is as follows in Gpa (psi x 10^6):

Compact bone:	21 (3)
Titanium:	96 (14)
Stainless Steel:	193 (28)
Cobalt-Chrome:	235 (34)

Correct Answer: Compact bone, titanium, stainless steel, cobalt-chrome

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43. (1001) Q1-1308:

In a patient with a previous compression hip screw in place at the time of total hip arthroplasty, what precautionary measures should be undertaken after hardware removal to prevent a periprosthetic fracture:

1) Cemented femoral component with cement augmentation of the screw holes, full weight bearing
3) Regular femoral prosthesis with toe touch weight bearing for 6 weeks
2) Plate augmentation with circlage wires, protected weight bearing
5) Bypassing the last screw hole with a cemented femoral component by two cortical diameters, protected weight bearing
4) Cortical strut allograft, protected weight bearing

Stress risers are generated when a screw is removed from the femur, weakening the bone for at least 4 weeks. Larger defects (50% of the cortical width) can reduce torsional strength up to 44%. Bypassing the defect by two cortical diameters with a cemented stem doubles the bone?s strength.Correct Answer: Bypassing the last screw hole with a cemented femoral component by two cortical diameters, protected weight bearing

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44. (1002) Q1-1309:

Which of the following radiographic changes can be expected after placement of a fully porous-coated cobalt chrome femoral stem:

1) Proximal femoral osteopenia
3) Radiolucency around the acetabular cup
2) Distal femoral osteopenia
5) Osteopenia adjacent to the entire femoral component
4) Increased mineralization proximally

The most severe stress shielding occurs with an extensively porous-coated, chrome-cobalt stem. This occurs as the load is transferred from the hip joint to the proximal femur. The load that was previously carried by the hip joint is now shared by the implant. This change will lead to remodeling of the proximal femur, resulting in a decreased density and thinning of the proximal portion of the femur. In a group of patients characterized as having severs stress shielding based on plain radiographs, no adverse effects were noted n terms of hip scores, presence of osteolysis, or need for revision.Correct Answer: Proximal femoral osteopenia

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45. (1003) Q1-1310:

Noncircumferential porous coating has been shown to lead to which adverse affect:

1) Increased rates of infection
3) Increased rates of distal osteolysis and late femoral loosening
2) Increased rates of stress shielding
5) Increased rates of acetabular osteolysis and late cup loosening
4) Increased rates of thigh pain

Noncircumferential porous coating may allow a pathway for particulate debris (polywear) to the distal part of the stem, promoting osteolysis.Correct Answer: Increased rates of distal osteolysis and late femoral loosening

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46. (1004) Q1-1311:

Position for hip arthrodesis is best stated as:

1) Neutral abduction/adduction, 20Â° to 30Â° flexion, neutral internal/external rotation
3) 20Â° abduction, 20Â° to 30Âº flexion, neutral internal/external rotation
2) Neutral abduction/adduction, full extension, neutral internal/external rotation
5) Neutral abduction/adduction, 45Â° flexion, neutral internal/external rotation
4) Neutral abduction/adduction, 20Â° to 30Â° flexion, 15Â° to 20Â° internal rotation

The favored position of arthrodesis is 20Â° to 30Âº flexion, neutral (or minimal adduction) adduction/abduction, and neutral internal/external rotation (can be slight external rotation). Insufficient flexion makes sitting difficult, while too much will make standing difficult due to increased lumbar lordosis. Abduction and internal rotation should be avoided.Correct Answer: Neutral abduction/adduction, 20Â° to 30Â° flexion, neutral internal/external rotation

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47. (1005) Q1-1312:

The position putting a total hip arthroplasty most at risk for an anterior dislocation is:

1) Flexion, adduction, internal rotation
3) Extension, adduction, external rotation
2) Flexion, abduction, internal rotation
5) Flexion, adduction, external rotation
4) Extension, adduction, internal rotation

The most common direction for dislocation of a total hip arthroplasty is posterior. It may be associated with a posterior approach, poor technique, and/or previous surgery. Posterior dislocations can be accentuated by placing the hip in flexion, adduction, and internal rotation (i.e., rising from a low-seated chair). Less common anterior dislocations can occur after an anterior approach or with anteversion of the cup or femoral component (or both). The position for dislocation is accentuated by extension, adduction, and external rotation.Correct Answer: Extension, adduction, external rotation

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48. (1006) Q1-1313:

Loosening of a cemented metal backed polyethylene acetabular component occurs at which of the following junctions:

1) The cement bone interface
3) The metal polyethylene interface as a result of micromotion
2) The cement metal interface
5) Both the cement-bone and cement-metal interface
4) Result of fracture and dissolution through the structure of the cement itself

Autopsy studies have shown that the loosening of cemented components occurs at the cement bone interface. This loosening occurs first at the periphery and proceeds toward the dome. This is most likely an extension of the pseudocapsule. The bone resorption at the cement-bone interface appears to be a result of a response to polyethylene debris.Correct Answer: The cement bone interface

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49. (1007) Q1-1314:

Placement of a screw in the anterior superior quadrant of the acetabulum will place which structure at risk:

1) Internal iliac artery
3) Common iliac vein
2) Bladder
5) Common iliac artery
4) External iliac vein

Placement of screws in the acetabular cup in the anterior superior or anterior inferior quadrant is not advised due to the proximity of the external iliac vein and the obturator artery, respectively.Correct Answer: External iliac vein

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50. (1008) Q1-1315:

During revision surgery for a total hip arthroplasty, the accepted standard for the presence of an infection on frozen tissue histological analysis is:

1) Five mononuclear cells per high-powered field
3) Five polymorphonuclear cells per high-powered field
2) Ten mononuclear cells per high-powered field
5) One bacterium per high-powered field
4) Ten polymorphonuclear cells per high-powered field

Frozen section analysis is important in revision surgery to determine why a component has become loose. Ten polymorphonuclear cells (PMNs) per high-powered field lowers the sensitivity for infection but does not reduce the specificity to diagnose an infection. Five PMNs per high-powered field is the current standard that is accepted as diagnostic for an infection. Mononuclear cells can be present in the face of aseptic loosening or polywear disease. PMNs are diagnostic of a biologic infectious response.Correct Answer: Five polymorphonuclear cells per high-powered field

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51. (1009) Q1-1316:

Which of the following is not a significant risk factor for the development of heterotopic ossification:

1) Hypertrophic osteoarthritis
3) Posttraumatic arthritis
2) Ankylosing spondylitis
5) Previous formation of heterotopic ossification
4) Previous osteonecrosis

Heterotopic ossification is seen more in men than in women. It is also more common in patients with hypertrophic osteoarthritis, posttraumatic arthritis, ankylosing spondylitis, longer operative times, and especially previous heterotopic bone formation. Anterior and lateral approaches have a higher incidence.Correct Answer: Previous osteonecrosis

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52. (1010) Q1-1317:

Long stemmed tibial components for revision total knee arthroplasty are not cemented for which of the following reasons:

1) Extensive stress shielding
3) Infection risk
2) Difficulty in removal
5) Hypotension with insertion
4) Asymmetric wear

A cemented tibial stem will stress shield the tibial cortex for the entire length of the stem. Proximal bone resorption will occur as a result.Correct Answer: Extensive stress shielding

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53. (1011) Q1-1318:

Unicompartmental arthroplasty is contraindicated in which patient:

1) A patient with osteonecrosis of medial condyle
3) A patient with rheumatoid arthritis concentrated in the medial compartment
2) A patient with osteoarthritis of medial condyle
5) A patient with prior patellectomy with medial compartment osteoarthritis
4) A patient with posttraumatic arthritis of the medial tibial plateau

Unicompartmental arthroplasty is a viable alternative to total knee arthroplasty in select patients. The most common indications for unicompartmental replacement are osteonecrosis, osteoarthritis, and posttraumatic arthritis isolated to one compartment. Patients with prior patellectomies may do well with a unicompartmental replacement. Contraindications to unicompartmental replacement are inflammatory arthritides (i.e., rheumatoid arthritis) due to whole knee involvement, young patients unwilling to stop work or sport, or a history of recent infection.Correct Answer: A patient with rheumatoid arthritis concentrated in the medial compartment

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54. (1012) Q1-1319:

If a metal-backed tibial component is used for total knee arthroplasty, what is the minimum thickness of polyethylene to be used to prevent accelerated wear:

1) 4 mm to 6 mm
3) 8 mm to 10 mm
2) 12 mm to 14 mm
5) Whatever polyethylene thickness balances the knee correctly
4) 10 mm to 12 mm

If a metal-backed tibial component is used in total knee arthroplasty, a minimum component thickness of 8 mm to 10 mm of polyethylene should be used. Contact stresses increase dramatically and non-linearly as a thickness of 6 mm or less is used.Correct Answer: 8 mm to 10 mm

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55. (1013) Q1-1320:

Which of the following is not a contraindication for high tibial osteotomy to treat medial compartment arthritis:

1) Obesity
3) Rheumatoid arthritis
2) Age greater than 65
5) A young patient unwilling to stop high activity occupation
4) Prior medial and lateral menisectomy

High tibial osteotomy can be performed in younger individuals with isolated medial compartment disease. High impact an excessive loading activities can be tolerated after osteotomy, whereas these activities are prohibited with prosthetic joint replacement. Contraindications include those older than 65 years of age, inflammatory arthritis, and previous medial and lateral menisectomies, as they would be better served with total joint arthroplasty. Obesity is associated with early failure in high tibial osteotomy.Correct Answer: A young patient unwilling to stop high activity occupation

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56. (1014) Q1-1321:

In preoperative evaluation for total knee arthroplasty, a patient is seen to have three previous incisions over the anterior knee. Two are longitudinal, 2.5 cm apart over the anterior aspect of the patella. One is transverse. All incisions are healed. Which incision should be used to decrease the likelihood of skin necrosis:

1) The medial most longitudinal incision
3) The transverse incision as the skin will slough with either of the previous longitudinal incisions
2) The lateral most longitudinal incision
5) The longitudinal incision that will allow for best exposure
4) A new midline incision between the two longitudinal incision

Prior surgical incisions are a potential for post-operative wound problems. Usually, the lateral most longitudinal incision is best used. A large lateral flap has been associated with postoperative wound problems. The lateral flap has shown less oxygen concentration in studies, therefore, making a small lateral flap is preferred. Transverse incisions can be crossed with relative impunity if the angle is greater than 60Âº.Correct Answer: The lateral most longitudinal incision

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57. (1015) Q1-1322:

A patient who underwent a posterior stabilized total knee arthroplasty 10 months ago has new complaints of knee pain and popping. This pain was exacerbated with climbing stairs and rising from a chair. An audible and palpable clunk is heard with terminal extension. Range of motion is from 0Â° to 110Âº, and there is no evidence of instability with examination. A pop is felt with active extension in the terminal 15Â° to 30Âº of motion. The best treatment is:

1) Revision arthroplasty
3) Revision to a condylar constrained type prosthesis
2) Nonsteroidal anti-inflammatory medicines
5) Patellectomy
4) Arthroscopic debridement or open revision of the patellar component

Patellar "clunk" syndrome is a type of peripatellar fibrous hyperplasia characterized by a discrete suprapatellar fibrous nodule. This nodule lodges into the femoral component intercondylar notch dung flexion and displaces with an audible, often painful, clunk with extension. This condition is isolated to posterior stabilized femoral components, and not evident in posterior cruciate ligament retaining prostheses. Initial treatment is physical therapy, which is sometimes successful. Most commonly, either an arthroscopic debridement or open revision of the patellar component and fibrous hyperplasia is needed for resolution of symptoms.Correct Answer: Arthroscopic debridement or open revision of the patellar component

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58. (1016) Q1-1323:

A patient has a displaced supracondylar femur fracture 6 cm proximal to a well-fixed, posterior stabilized component. This knee was asymptomatic prior to fracture. Treatment should include which of the following:

1) Cast bracing
3) Revision to a long stemmed femoral component
2) Traction
5) Plate fixation (Dynamic Condylar Screw or fixed angle blade) with retention of femoral component
4) Retrograde nail fixation with retention of femoral component

In fractures above a well-fixed femoral component, all attempts should be made to retain the component. The fracture must be aligned correctly and stabilized to permit early range of motion of the extremity. Casting or traction will likely result in loss of motion, while early range of motion without internal fixation can lead to malunion. Posterior stabilized femoral components with closed housing prohibit retrograde intramedullary nailing.Correct Answer: Plate fixation (Dynamic Condylar Screw or fixed angle blade) with retention of femoral component

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59. (1017) Q1-1324:

Resection of too little distal femur will have what effect on the "flexion/extension gap" with regard to ligamentous balancing:

1) Increase flexion gap (loose in flexion)
3) Decrease flexion gap (tight in flexion)
2) Increase extension gap (recurvatum)
5) Will not affect gap if appropriate polyethylene is used
4) Decrease extension gap (flexion contracture)

The extension gap is created with the distal femur and the proximal tibial cuts. The flexion gap is created with the posterior femur and the proximal tibial cuts. Altering the tibial cut will alter the flexion and extension gaps equally. Altering the distal femur cut alone will have an effect exclusively on the extension gap.Correct Answer: Decrease extension gap (flexion contracture)

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60. (1018) Q1-1325:

Excessive internal rotation of the tibial component should be avoided because of which resultant effect:

1) Net internal rotation of tibial tubercle, increased wear
3) Net internal rotation of the leg causing the patient to in-toe
2) Net external rotation of tibial tubercle, patellar subluxation
5) Will likely have no effect if ligaments are balanced
4) Net external rotation of the leg causing thigh pain

Internal rotation of the tibial component will cause external rotation of the tibial tubercle with an increased Q angle. An increased Q angle will cause an increase in patellar subluxation force and maltracking.Correct Answer: Net external rotation of tibial tubercle, patellar subluxation

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61. (1019) Q1-1326:

A 65-year-old patient presents with complaints of giving way in her knee. She underwent a total knee arthroplasty 2 years ago. Intraoperatively, the medial collateral ligament was disrupted, but repaired primarily. This has gone on to give the patient instability when she ambulates. Physical therapy and bracing have not helped. On radiographic examination, the components are well fixed and in appropriate position. Physical examination reveals a range of motion from 0Â° to 130Â° with no anteroposterior laxity. There is laxity at 0Â°, 45Â°, and 90Âº to valgus stress. Appropriate treatment should now consist of:

1) Ipsilateral semitendinosis and gracillis autograft reconstruction of the medial collateral ligament
3) Allograft Achilles tendon reconstruction of the medial collateral ligament
2) Contralateral semitendinosis and gracillis autograft reconstruction of the medial collateral ligament
5) Revision to a constrained-condylar type prosthesis
4) Contralateral bone-patellar-tendon autograft reconstruction of the medial collateral ligament

This patient has an incompetent medial collateral ligament throughout range of motion. If the disruption is caught early enough in surgery, primary repair can be made with satisfactory results. Ligamentous reconstruction without conversion to a constrained prosthesis with varus/valgus stability has been shown to be ineffective.Correct Answer: Revision to a constrained-condylar type prosthesis

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62. (1020) Q1-1327:

When comparing the subvastus approach to the medial parapatellar approach to the knee for total knee arthroplasty, which of the following statements is true:

1) Range of motion is better long term for the subvastus approach.
3) The subvastus approach is more technically difficult and exposure is more difficult than a medial parapatellar approach.
2) The need for lateral retinacular release is more common in the medial parapatellar approach.
5) The subvastus approach is associated with more wound complications than the medial parapatellar approach.
4) Patella subluxation is more common in the medial parapatellar approach.

The subvastus approach is associated with less wound complications than the medial parapatellar incision. The skin can be tight in flexion with a medial parapatellar incision; however, this is not common with the subvastus incision. In a series of 28 bilateral knees, Ritter and colleagues, compared a subvastus approach with the traditional medial parapatellar approach. Complications and range of motion between sides were equal. They did note, however, that exposure was much more difficult with the subvastus approach.Correct Answer: The subvastus approach is more technically difficult and exposure is more difficult than a medial parapatellar approach.

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63. (1021) Q1-1328:

The most common extensor mechanism complication in total knee arthroplasty is:

1) Patella fracture
3) Patellar clunk
2) Patellar instability
5) Patellar tendon rupture
4) Quadriceps tendon rupture

Patellar instability is the most frequent extensor mechanism complication. Most often it is manifested as subluxations or dislocation. Sometimes abnormal component wear or patella fractures are a result of abnormal patellar tracking. These consequences are usually the inevitable result of component malposition, limb malalignment, improper patellar preparation, improper component design, or trauma. Each of these mechanisms may be at play whether or not the patella is resurfaced.Correct Answer: Patellar instability

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64. (1022) Q1-1329:

A patient with a 35Âº valgus deformity and a 20Â° flexion contracture of the knee undergoes primary total knee arthroplasty successfully. In the recovery room, the patient is seen to have no dorsiflexion of the foot or toes and numbness over the dorsum of the foot. There is no pain with passive range of motion of the foot and calf compartments are soft. The next appropriate step is:

1) Re-observation in 30 minutes, leg elevation, and ice
3) Fasciotomies of the leg
2) Bring the patient back to the operating room to explore the peroneal nerve
5) Strict extension splinting, removal of the constrictive dressings
4) Remove the dressings and flex the leg

Peroneal palsy after total knee arthroplasty is a rare but significant complication after total knee arthroplasty. Incidence is higher in revision surgeries and those with flexion and valgus contractures. Postoperative constrictive dressings and hematomas may also cause or contribute to nerve ischemia or injury. Treatment of the peroneal palsy should initially be nonoperative. Removal of constrictive dressings and flexion of the knee will relieve pressure on the peroneal nerve. AFO will help with ambulation. Surgical exploration of the nerve is of no value and may exacerbate injury.Correct Answer: Remove the dressings and flex the leg

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65. (1023) Q1-1330:

A 70-year-old patient with a past history of prostate cancer treated with pelvic irradiation wishes to have a total hip arthroplasty for severe unilateral hip osteoarthritis. What is the most likely consequence of cementless fixation of the acetabular cup:

1) Fracture
3) Thromboembolic phenomenon
2) Bleeding
5) Aseptic loosening of the acetabular cup
4) Abductor weakness

Forty-four percent of patients in one study showed failure of fixation to bone of the acetabular cup after previous pelvic irradiation. This study demonstrates the high failure of porous ingrowth in the presence of previous irradiation in the acetabulum. It is therefore recommended to cement the acetabular cup or to use a protrusio-type cage with cement in this subset of patients. This is secondary to the loss of vascularity and viability of the bone caused by irradiation.Correct Answer: Aseptic loosening of the acetabular cup

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66. (1616) Q1-2010:

In patients with osteoarthritis, mechanical forces induce changes in the form and structure of many biologic materials including bone and cartilage. This effect is known as:

1) Wolffs law
3) Hilgenreiners law
2) Kochs postulate
5) Evans law
4) Singhs index

According to Wolffs law, stresses and strains contribute to bone density, strength, and ultimate shape of bone and internal trabecular arrangement.Correct Answer: Wolffs law

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67. (1617) Q1-2011:

The reduction mechanism of venous thromboembolism from epidural anesthesia in total joint replacement is:

1) Inhibition of platelet adhesion
3) Sympathetic effect of epidural blockage
2) Stimulation of endothelial fibrinolysis
5) Increased lower extremity blood flow
4) Decreased lower extremity blood flow

The sympathetic effect of epidural blockage results in increased lower extremity blood flow, which is responsible for the reduction of venous thromboembolism by mitigating the adverse effects of stress.Correct Answer: Sympathetic effect of epidural blockage

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68. (1618) Q1-2012:

Which of the following is not a clinical sign of pulmonary embolism:

1) Pleuritic chest pain and pleural rub
3) Tachypnea
2) Bradycardia
5) Pleural rub
4) Dyspnea

Tachycardia, as well as pleuritic chest pain, pleural rub, tachypnea, and dyspnea, are the most common clinical symptoms of pulmonary embolism. Bradycardia is not a clinical sign of pulmonary embolism.Correct Answer: Bradycardia

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69. (1619) Q1-2013:

In total joint replacement, osteolysis that results in bone loss and bone resorption is caused by:

1) Breakdown of polymethylmethacrylate
3) Metal debris
2) Polyethylene debris
5) Allergic reaction to titanium
4) Hydroxyapatite

Osteolysis, which results in bone loss and bone resorption, is caused by polyethylene debris.Correct Answer: Polyethylene debris

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70. (1620) Q1-2014:

Bone grafts (autograft) used to restore bone stock in total joint replacements are the result of what biologic process:

1) Osteogenesis
3) Osteoconduction
2) Osteoinduction
5) Osteogenesis, osteoinduction, and osteoconduction
4) Osteogenesis and osteoinduction

Bone formation from osteoblasts (osteogenesis), recruiting host mesenchymal cells and differentiating them into bone-forming cells (osteoinduction), and the ingrowth of blood vessels and osteoprogenitor cells (osteoinduction) are important in influencing bone graft function.Correct Answer: Osteogenesis, osteoinduction, and osteoconduction

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71. (1621) Q1-2015:

Ceramics are used as an osteoconductive bone-graft material. The optimal pore size is:

1) 50 [mu]m to 100 [mu]m
3) 150 [mu]m to 500 [mu]m
2) 100 [mu]m to 150 [mu]m
5) 800 [mu]m to 1000 [mu]m
4) 500 [mu]m to 700 [mu]m

The optimal pore size of osteoconductive ceramics is between 150 [mu]m to 500 [mu]m. Smaller or larger pore sizes are not as effective.Correct Answer: 150 [mu]m to 500 [mu]m

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72. (1622) Q1-2016:

The American College of Cardiology recommends that a patient wait how long after a myocardial infarction before undergoing a total hip replacement:

1) 3 weeks
3) 3 months
2) 6 weeks
5) 1 year
4) 6 months

The American College of Cardiology presently recommends that a patient wait 6 weeks after a myocardial infarction before undergoing a total hip replacement. There is increased risk of complication if a total hip replacement is performed before 6 weeks.Correct Answer: 6 weeks

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73. (1623) Q1-2017:

Patients with rheumatoid arthritis must be radiologically evaluated for this condition:

1) Odontoid abnormality
3) C2 - C3 subluxation
2) C1 - C2 subluxation
5) C4-C5 subluxation
4) C3 - C4 subluxation

Patients with rheumatoid arthritis must be carefully evaluated for cervical spine subluxation, which is characterized by atlantoaxial translation on flexion-extension views of the cervical spine.Correct Answer: C1 - C2 subluxation

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74. (1624) Q1-2018:

In hypotensive total joint replacement surgery, the mean blood pressure is kept at:

1) 50 mm Hg
3) 70 mm Hg
2) 60 mm Hg
5) 90 mm Hg
4) 80 mm Hg

Using a combination of volatile anesthetics, narcotics, and vasodilators, the mean blood pressure is kept at 60 mm Hg during hypotensive total joint replacement surgery. This is the lowest pressure that can be obtained and still be within safety parameters.Correct Answer: 60 mm Hg

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75. (1625) Q1-2019:

The optimal position of a patientâs knee during total knee replacement surgery is:

1) 3Â° of anatomic valgus
3) 7Â° of anatomic valgus
2) 5Â° of anatomic valgus
5) Neutral
4) 8Â° of anatomic valgus

The optimal position of a patientâs knee during total knee replacement surgery is 7Â° of anatomic valgus as measured between the mechanical and anatomic axis. More or less valgus is not optimal.Correct Answer: 7Â° of anatomic valgus

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76. (1626) Q1-2020:

The optimal position for the acetabular cup during total hip replacement surgery is:

1) Neutral version
3) 15Â° anteversion
2) 5Â° anteversion
5) 45Â° anteversion
4) 30Â° anteversion

The optimal cup position of a patientâs hip during total hip replacement surgery is 15Â° of cup anteversion as measured on a lateral radiograph of the groin. More or less anteversion is not optimal. The femoral stem version needs to be part of the equation.Correct Answer: 15Â° anteversion

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77. (1627) Q1-2021:

Gallium-67 citrate used in scanning techniques can result in increased gallium-67 localization in:

1) Infection
3) Aseptic loosening
2) Fracture
5) Infection, fracture, and aseptic loosening
4) Infection and fracture

Although increased gallium-67 citrate localization is found in infection, there are also significant false-positive results in fracture and aseptic loosening. It is more specific for infection but increased localization is seen in all three conditions.Correct Answer: Infection, fracture, and aseptic loosening

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78. (1628) Q1-2022:

The most specific scanning method to detect infection in total joint replacement is:

1) White blood cell scanning
3) Sequential technetium bone scans
2) Technetium bone scanning
5) A combination of white blood cell scanning and technetium bone scanning
4) Sequential gallium-67 citrate scans

White blood cell scanning combined with technetium bone scanning is more specific for the diagnosis of infection than sequential technetium bone scans or sequential gallium-67 citrate scans.Correct Answer: A combination of white blood cell scanning and technetium bone scanning

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79. (1629) Q1-2023:

Outcomes, as opposed to traditional results, are more reliable because they include:

1) Measured and recorded clinical results
3) Social consequences and political consequences
2) Economic consequences only
5) Measured and recorded clinical results, economic consequences, and social consequences
4) Political consequences only

The study of outcomes is characterized by broadening the definition of surgical results from strictly clinical to the economic, social, and political consequences. All of these factors must be considered in analyzing surgical results in the study of outcomes.Correct Answer: Measured and recorded clinical results, economic consequences, and social consequences

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80. (1630) Q1-2025:

The anterolateral (Watson-Jones) approach to the hip dissects in an interval between:

1) The gluteus medius and gluteus minimus
3) The tension fascia lata muscles and rectus femoris
2) The gluteus medius and tensor fascia lata muscles
5) The gluteus maximus
4) The gluteus medius and quadratus femoris

The anterolateral exposure dissects an interval between the gluteus medius and tensor fascia lata muscles to preserve the superior gluteal innervation of the tensor fascia muscles. The other intervals are not used in the anterolateral approach.Correct Answer: The gluteus medius and tensor fascia lata muscles

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81. (1631) Q1-2026:

The direct lateral (modified Hardinge) approach to the hip has the following disadvantage(s):

1) Limited proximal acetabular exposure
3) Slower abductor rehabilitation
2) Increased incidence of heterotopic ossification
5) Limited proximal acetabular exposure, increased heterotopic ossification, and slower abductor rehabilitation
4) Increased heterotopic ossification and slower abductor rehabilitation

Limited proximal acetabular exposure, increased incidence of heterotopic ossification, and limp secondary to weak abductors are commonly associated with the direct lateral approach. The dislocation rate is less than with a posterior approach.Correct Answer: Limited proximal acetabular exposure, increased heterotopic ossification, and slower abductor rehabilitation

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82. (1632) Q1-2027:

When using the direct lateral (modified Hardinge) approach to the hip, the incidence of total hip dislocation is:

1) 2%
3) 0.3%
2) 0.1%
5) 4%
4) 3%

In a retrospective review of 770 consecutive primary total hip arthroplasties, the dislocation rate was 0.3%. Higher dislocation rates are associated with the posterior approach.Correct Answer: 0.3%

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83. (1633) Q1-2028:

When using the direct lateral (modified Hardinge) approach for total hip replacement, what percentage of patients will have a moderate or severe limp at 2 years postoperative:

1) 0.5%
3) 5%
2) 1%
5) 15%
4) 10%

According to Mulliken and colleagues, the incidence of moderate or severe limp at 2 years postoperative is 10%. This is a significant incidence, but the dislocation rate is much lower than the other approaches to the hip.Correct Answer: 10%

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84. (1634) Q1-2029:

The posterior approach to the hip has the following advantage(s) over the direct lateral approach when performing total hip arthroplasty:

1) Easy exposure
3) Decreased heterotopic ossification
2) Decreased operative time
5) Decreased operative time and decreased heterotopic exposure
4) Easy exposure, decreased operative time, and decreased heterotopic ossification

Easy exposure, decreased operative time, and decreased heterotopic ossification are advantages of using the posterior approach. It is, however, important to note that the posterior approach is associated with a higher rate of dislocation.Correct Answer: Easy exposure, decreased operative time, and decreased heterotopic ossification

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85. (1635) Q1-2030:

The posterior approach splits the following muscle(s) when exposing the hip:

1) Gluteus medius
3) Gluteus minimus
2) Gluteus maximus
5) External rotators
4) Tensor fascia lata

The posterior approach splits the gluteus maximus. The remainder of the approach releases the short external rotators followed by a posterior capsulotomy, which then allows entry into the posterior hip joint.Correct Answer: Gluteus maximus

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86. (1636) Q1-2031:

The trochanteric slide osteotomy involves:

1) Osteotomy of anterior greater trochanter bone
3) Osteotomy of anterior greater trochanter bone and keeping the gluteus medius in continuity
2) Keeping the gluteus medius and vastus lateralis in continuity
5) Osteotomy of anterior greater trochanter bone and keeping the gluteus medius and vastus lateralis in continuity
4) Osteotomy of anterior greater trochanter bone and keeping the vastus lateralis in continuity

The trochanteric slide osteotomy is a modification of the Charnley transtrochanteric approach. The trochanteric slide osteotomy was developed because of concerns with trochanteric reattachment and possible nonunion of the trochanteric fragments. The trochanteric slide osteotomy also improves visualization in difficult primary arthroplasties, as well as in revision arthroplasty.Correct Answer: Osteotomy of anterior greater trochanter bone and keeping the gluteus medius and vastus lateralis in continuity

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87. (1637) Q1-2032:

The vastus slide utilizes a:

1) Modified anterior approach to the hip joint
3) The vastus lateralis is reflected off the proximal femur from its posterior attachment to the lateral intermuscular septum.
2) A trochanteric osteotomy
5) Posterior approach to the hip
4) Modified anterior approach to the hip joint and trochanteric osteotomy

The vastus slide is a modified lateral approach to the hip and does not involve a trochanteric osteotomy. The vastus slide provides good exposure of the proximal femur in revision hip surgery but is not recommended for complicated acetabular reconstruction.Correct Answer: The vastus lateralis is reflected off the proximal femur from its posterior attachment to the lateral intermuscular septum.

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88. (1638) Q1-2033:

To perform an extended trochanteric osteotomy:

1) The posterior approach is extended distally along the posterior border of the gluteus medius.
3) The gluteus maximus muscle is detected.
2) The posterior portion of the vastus lateralis is identified.
5) All of the above
4) The interval between the posterior vastus and gluteus maximus is developed.

In addition to all of the above steps, the lateral-third of the proximal femur is osteotomized using an oscillating saw or burr.Correct Answer: All of the above

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89. (1639) Q1-2034:

The advantage(s) of an extended trochanteric osteotomy in approaching a revision hip surgery include:

1) Easier access to bone-cement interface
3) Better exposure of acetabulum
2) Decreased operative time
5) Easier access to bone-cement interface and decreased operative time
4) Easier access to bone-cement interface, decreased operative time, and better exposure of acetabulum

In addition to the answers above, there is more predictable healing of the osteotomized fragment, neutral recovery of femoral canal, and better tensioning of the abductors with distal advancement.Correct Answer: Easier access to bone-cement interface, decreased operative time, and better exposure of acetabulum

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90. (1640) Q1-2035:

The anatomy of the hip provides considerable rotation in:

1) One anatomic plane
3) Three anatomic planes
2) Two anatomic planes
5) Six anatomic planes
4) Four anatomic planes

The anatomy of the hip provides rotation in three anatomic planes (sagittal, coronal, and transverse). To understand the hip anatomy and rotation, one must consider all three anatomical planes.Correct Answer: Three anatomic planes

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91. (1641) Q1-2036:

Most patients have a hip flexion-extension arc of:

1) 100Â° to 110Â°
3) 120Â° to 140Â°
2) 110Â° to 120Â°
5) 110Â° to 140Â°
4) 130Â° to 150Â°

Most patients have a flexion-extension arc of 120Â° to 140Â°, an abduction-adduction arc of 60Â° to 80Â°, and an internal-external rotation arc of 60Â° to 90Â°. The vast majority of patients have a flexion-extension arc of 120Â° to 140Â°.Correct Answer: 120Â° to 140Â°

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92. (1642) Q1-2037:

Femoral implants with greater anteversion will impinge (trochanter against the pelvis):

1) Posteriorly in extension with lesser external rotation
3) Posteriorly in flexion with lesser external rotation
2) Anteriorly in extension with lesser external rotation
5) Posteriorly in extension with lesser internal rotation
4) Anteriorly in flexion with lesser external rotation

Proximal femoral implants with greater anteversion impinge trochanter against pelvis with lesser external rotation, whereas proximal femoral implants with lesser anteversion tend to impinge anteriorly in flexion with lesser internal rotation.Correct Answer: Posteriorly in extension with lesser external rotation

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93. (1643) Q1-2038:

Level walking requires the following hip range of motion:

1) 40Â° of flexion-extension and the same internal-external rotation/abduction-adduction
3) 70Â° of flexion-extension and the same internal-external rotation/abduction-adduction
2) 55Â° of flexion-extension and the same internal-external rotation/abduction-adduction
5) 90Â° of flexion-extension and the same internal-external rotation/abduction-adduction
4) 80Â° of flexion-extension and the same internal-external rotation/abduction-adduction

Level walking requires approximately 50Â° to 60Â° of flexion-extension with a relatively small amount of internal-external rotation or abduction-adduction.Correct Answer: 55Â° of flexion-extension and the same internal-external rotation/abduction-adduction

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94. (1644) Q1-2039:

To put on a pair of shoes, the arc of motion required in the hip joint is:

1) 100Â°
3) 140Â°
2) 130Â°
5) 180Â°
4) 170Â°

The total motion of the three anatomic planar arcs of the hip is 240Â° to 300Â°. The arc of motion required to put on a pair of shoes is 160Â° to 170Â°.Correct Answer: 170Â°

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95. (1645) Q1-2040:

Recent mathematical modeling of hip joint forces during activities of daily living relative to body weight show elevations by a factor of:

1) 1 to 2
3) 2 to 4
2) 2 to 3
5) 4 to 6
4) 3 to 5

Recent mathematical modeling studies show that hip joint forces are approximately 2 to 4 times body weight. The hip joint forces will increase with strenuous activities, especially exercise.Correct Answer: 2 to 4

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96. (1646) Q1-2041:

Implantation of a total hip prosthesis can significantly alter hip forces. The lowest forces occur at the:

1) Anatomic hip center
3) Superior anatomic hip center
2) Lateral anatomic hip center
5) Inferior anatomic hip center
4) Posterior anatomic hip center

The lowest forces occur at the anatomic hip center and increase farther away from the anatomic center. Therefore, the forces increase in all directions from the anatomic center.Correct Answer: Anatomic hip center

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97. (1647) Q1-2042:

Implantation of a total hip prosthesis can significantly alter hip forces. The greatest increase in hip forces occur at the:

1) Anatomic hip center
3) Superior anatomic hip center
2) Lateral anatomic hip center
5) Inferior anatomic hip center
4) Posterior anatomic hip center

The highest forces occur when the total hip replacement is lateral to the anatomic hip center. The forces in all of the other directions are decreased compared to the lateral anatomic hip center.Correct Answer: Lateral anatomic hip center

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98. (1648) Q1-2043:

When implanting a total hip prosthesis, the greatest strains occur at what part of the femoral implant:

1) Neck of the femoral anatomy
3) Calcar
2) Greater trochanteric
5) Tip of the prosthesis
4) Midportion of the prosthesis

Strains are reduced in the calcar by as much as 90%, but the tip of the prosthesis experiences increased strain. The neck of the femoral anatomy, greater trochanter area, and midportion of the prosthesis experience strain but not as great as the tip of the prosthesis.Correct Answer: Tip of the prosthesis

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99. (1649) Q1-2044:

What percentage of bone is turned over in the skeleton each year:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

Bone normally exhibits a turnover rate of roughly 5% of the skeleton each year. A skeleton may exhibit more turnover of bone in certain disease states, but 5% is the average for the normal person.Correct Answer: 5%

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100. (1650) Q1-2045:

The stem and mantle is easily extracted in a failed hip arthroplasty if:

1) A circumferential lytic line surrounds the cement mantle
3) Ultrasound equipment is used
2) A circumferential lytic line surrounds the entire prosthesis
5) One uses an extended trochanteric osteotomy
4) There is a nonunion of the greater trochanteric osteotomy

If a circumferential lytic line is evident on radiographs, then the bond between the stem and the cement is stronger than the bond between the cement and the bone. In this condition, the stem and mantle are easily extracted as a unit.Correct Answer: A circumferential lytic line surrounds the cement mantle

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101. (1651) Q1-2046:

After removing a femoral stem, the best way to prevent fracture of the femur is:

1) Debulk the metaphyseal cement
3) Trochanteric osteotomy
2) Debulk the diaphyseal cement
5) Use a quarter-inch osteotome
4) Remove the fibrous layer of tissue

Metaphyseal cement tends to be bulky, and the bone tends to be thin and weak. Initial debulking of the cement with a high-speed burr prevents fracture during attempts at removal of the cement.Correct Answer: Debulk the metaphyseal cement

---

102. (1652) Q1-2047:

When removing the cement mantle by cementing a threaded extractor into the mantle, the polymethylmethacrylate (PMMA) can be removed because:

1) The bond of the PMMA to the bone is weak.
3) The bond of the new PMMA to the old PMMA is weak.
2) The bond of the PMMA to the bone is strong.
5) The bond of the new PMMA to the old PMMA is stronger than the bond of PMMA to bone.
4) The bond of the new PMMA to the old PMMA is strong.

Because the bond of the PMMA to PMMA is stronger then the bond of PMMA to bone, the mantle can be removed in a piecemeal fashion using a threaded extractor. It is often necessary to cement in the extractor multiple times when performing this removal technique.Correct Answer: The bond of the new PMMA to the old PMMA is stronger than the bond of PMMA to bone.

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103. (1653) Q1-2048:

Which of the following statements is not true of polymethylmethacrylate (PMMA):

1) PMMA is a grout.
3) PMMA is strongest in compression.
2) PMMA is strongest in tension and weakest in compression.
5) PMMA is strongest in compression and weakest in tension.
4) PMMA is weakest in tension.

PMMA is a grout and is strong in compression and weak in tension. Tension forces ultimately cause failure of PMMA.Correct Answer: PMMA is strongest in tension and weakest in compression.

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104. (1654) Q1-2049:

When making perforations in the cortex of the femur, the perforations should be placed:

1) Posteriorly
3) Medially
2) Laterally
5) Posterior laterally
4) Anteriorly

Perforations of the femur should be placed anteriorly or anterolaterally. The axis of neutral stress for the proximal femur is in a sagittal plane in the anterior femur.Correct Answer: Anteriorly

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105. (1655) Q1-2050:

When making a femoral window, the tip of the new stem must bypass the window by:

1) 1 cm
3) One femoral diameter
2) 2 cm
5) Three femoral diameters
4) Two femoral diameters

In the femoral window technique and the extended trochanteric technique, the revision stem must bypass the defect in the femoral cortex by at least two femoral diameters to prevent fracture adjacent to the osteotomy.Correct Answer: Two femoral diameters

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106. (1656) Q1-2051:

When making perforations in the cortex of the femur, the perforations should be placed how far apart:

1) 0.5 cm
3) One hole diameter
2) 5 cm
5) Three hole diameters
4) Two hole diameters

The holes placed in the anterior cortex in this article were 9 mm in diameter. This study showed that placing the hole less than two diameters apart increased the stress in the area between the holes, which could lead to an increased incidence of fracture.Correct Answer: Two hole diameters

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107. (1665) Q1-2060:

Reconstructive open methods to obtain femoral neck union of failed femoral neck fractures include all of the following except:

1) Meyers pedicle graft
3) Valgus intertrochanteric osteotomy
2) Varus osteotomy
5) Vascularized tensor fascia latae muscle bone graft
4) Free vascularized fibulae graft

The Meyers pedicle graft revascularizes the nonunion site. The valgus intertrochanteric osteotomy converts shear forces at the nonunion site to compressive forces and promotes fracture healing. These are the two most common reconstructive open methods. Varus osteotomy is not an open reconstructive method to obtain femoral neck union of a failed femoral neck fracture.Correct Answer: Varus osteotomy

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108. (1666) Q1-2061:

When deciding between a hemiarthroplasty and total hip replacement (THR) to serve as a salvage procedure for femoral neck nonunions, one may choose a THR because:

1) There is less risk of dislocation.
3) It is a smaller procedure.
2) There is better pain relief.
5) There is less change of leg length inequality.
4) Reimbursement is better.

THR provides better pain relief then a hemiarthroplasty, but THR is a bigger procedure with more risk of dislocation. There is an increased chance of leg length inequality with a THR, and reimbursement should never be a deciding factor for a particular surgery.Correct Answer: There is better pain relief.

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109. (1667) Q1-2062:

Which of the following is the preferred method for treating intertrochanteric nonunions in young patients:

1) Hemiarthroplasty
3) Blade plate and autogenous bone graft
2) Total hip replacement (THR)
5) Varus osteotomy
4) Gamma nail

Blade plate and autogenous bone graft is the preferred method for treating intertrochanteric nonunions in young patients. The femoral head will retain its vascularity and remain viable, so solutions such as hemiarthroplasty and THR should be reserved for older patients.Correct Answer: Blade plate and autogenous bone graft

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110. (1668) Q1-2063:

Which of the following is the best treatment for older patients with a failed intertrochanteric fracture and bone loss near the lesser trochanter:

1) Gamma nail
3) Standard total hip replacement
2) Blade plate and autogenous bone graft
5) Calcar replacement implant with long stem
4) Calcar replacement implant

A calcar replacement implant is required to provide leg length and gain hip stability, and a long-stem implant is often required to bypass screw holes in the femur.Correct Answer: Calcar replacement implant with long stem

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111. (1669) Q1-2064:

Which of the following factors is of least importance when considering the preoperative planning of a revision total knee replacement:

1) Bone loss and bone defects
3) Integrity of the collateral ligaments
2) Integrity of the extensor mechanism
5) Bone density
4) Soft tissue envelope including the skin

Adequate imaging and planning must include an assessment of the size and location of bone defects, the integrity of the extensor mechanism collateral ligaments, and the soft tissue envelope including the skin.Correct Answer: Bone density

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112. (1670) Q1-2065:

According to Enghâs classification of bone defects in failed total knee arthroplasty, type 2 defects usually require:

1) Cement filling
3) Augmented femoral or tibial components
2) Morcelized bone graft
5) Hinge component
4) Structural bone graft

Cement and morcelized bone graft are usually reserved for type 1 defects. Type 2 defects usually require an augmented femoral or tibial component, whereas type 3 defects require a structural bone graft and often a hinged component.Correct Answer: Augmented femoral or tibial components

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113. (1671) Q1-2066:

When using a structural bone graft in type 3 bone defects (Enghâs classification), which of the following statements is incorrect:

1) Step cut the bone allograft.
3) Use a stem to bypass the junction between host bone and graft by 1 cortical diameter.
2) Gain stability with plates.
5) Gain stability with screws.
4) Use a stem to bypass the junction between host bone and graft by 2 cortical diameters.

In type 3 defects (F3 or T3), it is necessary to step cut the allograft and gain stability by using plates and screws or cerclage wires. The stem between host bone and graft must bypass the junction by at least 2 cortical diameters.Correct Answer: Use a stem to bypass the junction between host bone and graft by 1 cortical diameter.

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114. (1672) Q1-2067:

Hip fusion is indicated for all of the following except:

1) Young patients
3) Patients who are not overweight
2) Patients with unilateral hip disease
5) Patients with bilateral hip disease
4) Young and active patients

Hip fusion is best indicated for the young and active, or heavy patient who does not have bilateral hip disease. Secondary pain occurs in the lumbosacral area in later years, but a good fusion obviates the possible need for multiple revision total hip replacements.Correct Answer: Patients with bilateral hip disease

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115. (1673) Q1-2068:

After at least 15 years of follow-up, what percent of patients with hip arthrodesis will have significant back or ipsilateral knee pain:

1) 20%
3) 60%
2) 40%
5) 90%
4) 80%

At 17 to 50 yearsâ follow-up, approximately 60% of patients with arthrodesis will have significant back or ipsilateral knee pain. Significant back or knee pain at 15 years must be balanced against revision total hip replacement at 15 years.Correct Answer: 60%

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116. (1674) Q1-2069:

For a successful hip arthrodesis, the hip should be fused in:

1) 10Â° flexion, neutral abduction/adduction, 0Â° of external rotation
3) 30Â° flexion, 10Â° abduction, 10Â° external rotation
2) 20Â° flexion, neutral abduction/adduction, 0Â° of external rotation
5) 15Â° flexion, 10Â° abduction, 0Â° external rotation
4) 15Â° flexion, 10Â° abduction, 10Â° external rotation

A successful hip arthrodesis depends on rigid fixation and proper positioning of the limb at 20Â° to 30Â° of flexion relative to the torso, neutral abduction/adduction, and 0Â° to 5Â° external rotation.Correct Answer: 20Â° flexion, neutral abduction/adduction, 0Â° of external rotation

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117. (1675) Q1-2070:

The most important factor in achieving a satisfactory result when converting a fused hip to a total hip arthroplasty is:

1) Placing the limb in proper positioning at time of fusion
3) Existence of low back pain
2) Preserving the abductor mechanism at time of fusion
5) Existence of contralateral hip pain
4) Existence of ipsilateral knee pain

Preservation of the abductor mechanism is the most important factor when converting an arthrodesis to a total hip arthroplasty.Correct Answer: Preserving the abductor mechanism at time of fusion

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118. (1676) Q1-2071:

Surgical exposure in total knee replacement is best facilitated by all of the following except:

1) Performing the surgery with the knee flexed
3) Removing a significant portion of the fat pad
2) Externally rotating the flexed knee and peeling off medial tissues subperiosteally
5) Keeping the fat pad intact
4) Cutting the patellofemoral ligament

Performing the surgery with the knee flexed, externally rotating the flexed knee and peeling off medial tissues subperiosteally, removing a significant portion of the fat pad, and cutting the patellofemoral ligament facilitate surgical exposure when performing a total knee replacement.Correct Answer: Keeping the fat pad intact

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119. (1677) Q1-2072:

To obtain good patellar tracking during total knee replacement, a surgeon must not:

1) Perform a lateral release
3) Position the patellar implant slightly medial on the patella
2) Place the femoral component in slight internal rotation
5) Check patellar tracking before performing the final cementing of the component
4) Place the femoral component in slight external rotation

A lateral release is not always required. The femoral component must be slightly externally rotated instead of internally rotated. The patella will track better if the patellar implant is positioned slightly medial.Correct Answer: Place the femoral component in slight internal rotation

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120. (1678) Q1-2073:

Bone cuts are more important than soft tissue balancing when performing a total knee replacement. The consideration least important in your decision making is

1) Soft tissue balance
3) Flexion-extension space balancing
2) Gender specific knee replacement
5) Adequate exposure
4) Bone cuts

Soft tissue balancing and flexion-extension space balancing are as important as the bone cuts.Correct Answer: Gender specific knee replacement

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121. (1679) Q1-2074:

In reviewing instability patterns of nonseptic revision total knee replacements, most total knee replacements required revision because of:

1) Malposition of implants
3) Residual varus, valgus, or flexion contracture
2) Flexion-extension mismatch
5) Bony cut malalignment
4) Soft tissue problems

Most nonseptic revision total knee replacements are a result of soft tissue problems (41%), followed by flexion-extension space mismatch (34%), and insufficient correction of an initial fixed deformity (21%). Only 4% were secondary to bony cut malalignment.Correct Answer: Soft tissue problems

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122. (1680) Q1-2075:

Which of the following is the best way to predict that a patient is able to obtain full extension after total knee replacement:

1) Resecting more femoral bone
3) Lifting the leg by the ankle in the extended position while pressing proximally on the sole of the foot
2) Deflating the tourniquet when checking for full extension
5) The knee will gradually come to full extension with physical therapy after surgery.
4) Sterilizing a goniometer and checking full extension at the time of surgery

Performing the âbounceâ or âpushâ test is the best test, performed at the time of trial reduction, to predict if a patient will achieve full extension postoperatively. One lifts the leg by the ankle in the extended position while pressing proximally on the sole of the foot.Correct Answer: Lifting the leg by the ankle in the extended position while pressing proximally on the sole of the foot

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123. (1681) Q1-2076:

Which of the following patients are least at risk for extensor-mechanism disruption after total knee replacement:

1) Patients with patellar baja
3) Patients with previous extensor-mechanism realignment
2) Obese patients
5) Thin patients
4) Patients with markedly diminished range of motion

Obese patients, patients with patellar baja, and patients with previous extensor-mechanism realignment, as well as patients with markedly diminished range of motion, are most at risk for extensor-mechanism disruption.Correct Answer: Thin patients

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124. (1682) Q1-2077:

Component factors associated with increased stress on the extensor mechanism include all of the following except:

1) An undersized femoral component
3) Anterior translation of the femoral component
2) A thick patella
5) Oversized femoral component
4) Elevation of the joint line

Increased stress on the extensor mechanism involves an oversized femoral component, anterior translation of the femoral component, a thick patella, and elevation of the joint line. An undersized femoral component does not increase the stress on the extensor mechanism.Correct Answer: An undersized femoral component

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125. (1683) Q1-2078:

Which of the following is the most common level of extensor-mechanism disruption after total knee replacement:

1) Quadriceps tendon rupture
3) Patellar fracture
2) Patellar tendon disruption
5) Quadriceps tendon insertion on the patella
4) Extensor tubercle avulsion

Patellar fracture is the most common level of extensor-mechanism disruption after total knee replacement; however, all of the above have been observed. This is often related to excessive resection of the patella when placing the patella component.Correct Answer: Patellar fracture

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126. (4046) Q1-2079:

Which of the following statements is not true regarding chronic patellar tendon ruptures:

1) Chronic patellar tendon ruptures are usually associated with abnormal tendons.
3) Chronic patellar tendon ruptures require an allograft substitution.
2) Chronic patellar tendon ruptures disrupt the extensor mechanism.
5) The patellar tendon is histologically normal.
4) Chronic patellar tendon ruptures may occur after total knee replacement.

Chronic patellar tendon ruptures can severely interfere with the extensor mechanism after total knee replacement. They are usually associated with an abnormal tendon and abnormal histology. Often, chronic patellar tendon ruptures must be substituted with an allograft to obtain reasonable function.Correct Answer: The patellar tendon is histologically normal.

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127. (1684) Q1-2080:

Which of the following is the best indication for hip arthroscopy:

1) Synovitis
3) Dysplasia
2) Osteonecrosis
5) Rheumatoid arthritis
4) Labral tears

Indications for hip arthroscopy include labral tears, loose bodies, synovial chondromatosis, chondral flap lesions, and foreign body removal. Hip arthroscopy is less important as a diagnostic tool for a disease entity, such as rheumatoid arthritis or osteonecrosis, because laboratory studies are more specific.Correct Answer: Labral tears

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128. (1685) Q1-2081:

Conventional magnetic resonance imaging can detect a labral tear of the hip what percent of the time:

1) 5%
3) 30%
2) 15%
5) 60%
4) 45%

Conventional magnetic resonance imaging is only 5% effective in detecting labral tears, but, if combined with gadolinium, its sensitivity is increased to 49%. The dye can more easily identify a labral tear, but it does not approach 100% effectiveness. Clinical symptoms and history are also important when considering hip arthroscopy.Correct Answer: 5%

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129. (1686) Q1-2082:

In dysplastic hips, labral tears most often occur in which of the following locations:

1) Posterior
3) Anterior
2) Lateral
5) Inferior
4) Equally distributed

Seventy-two percent of dysplastic hips had labral tears. Sixty-six percent of the tears were anterior, 5% were posterior, and 0.6% were lateral. In dysplastic hips, abnormal pressure is placed on the anterior labrum because of subluxation.Correct Answer: Anterior

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130. (1687) Q1-2083:

In terms of design for posterior stabilized implants, it is important for the components to incorporate _____ before impingement occurs.

1) No rotation
3) No flexion
2) Some hyperextension
5) 5Â° of valgus
4) Some flexion

It is important to incorporate some hyperextension in the posterior stabilized prosthesis because there is a tendency to place the femoral component in flexion and the tibial component in some posterior slope, which creates overall hyperextension.Correct Answer: Some hyperextension

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131. (1688) Q1-2084:

When using a primary total knee replacement implant in a patient with distal femoral bone loss:

1) The joint line will be moved proximally.
3) There will be loss of flexion.
2) There will be flexion instability.
5) The joint line remains unchanged.
4) The joint line will be moved distally.

One moves the joint line proximally with distal femoral bone loss resulting in extension instability and loss of flexion. Tibial bone loss moves the joint line distally. There is no flexion instability in a patient with distal femoral bone loss.Correct Answer: The joint line will be moved proximally.

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132. (1689) Q1-2085:

In revision total knee replacement, if one uses a revision femoral component that is thicker than the distal femoral bone loss, then:

1) The joint line will move proximally.
3) There will be lack of knee flexion.
2) The joint line will move distally.
5) There will be increased knee extension.
4) The joint line remains unchanged.

The joint line is moved distally. The knee does not extend fully and there will be resultant flexion instability.Correct Answer: The joint line will move distally.

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133. (1690) Q1-2086:

In a total knee replacement, when sizing the femur from posterior up, if the patient is between sizes and the larger size is implanted, then:

1) Quadriceps excursion will be increased
3) Quadriceps excursion remains unchanged
2) Range of motion will be limited
5) Range of motion remains unchanged
4) Range of motion increases

Implanting the larger size component will limit both quadriceps excursion and range of motion because it will âstuffâ the joint. The knee will have limited range of motion.Correct Answer: Range of motion will be limited

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134. (1691) Q1-2087:

In a total knee replacement, one of the consequences of sizing from anterior down, when in between sizes is that:

1) It decreases resection of the posterior condyle.
3) It creates a flexion gap.
2) It creates an extension gap.
5) It decreases extension.
4) It overstuffs the joint.

Sizing from anterior down will increase resection of the posterior condyle. This results in a flexion gap and flexion instability.Correct Answer: It creates a flexion gap.

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135. (1692) Q1-2088:

A flexion gap observed when trialing for a total knee replacement can be corrected by:

1) A thinner tibia insert and increased femoral resection
3) Resecting more tibia
2) A thicker tibia insert and increased femoral resection
5) A thicker tibia insert
4) Resecting more femur

Without going to a posterior stabilized total knee replacement, one can put in a thicker tibia insert and increase the femoral resection to correct a flexion gap. Resecting more tibia increases the flexion gap. Resecting more femur without a thicker tibia insert creates more instability.Correct Answer: A thicker tibia insert and increased femoral resection

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136. (1693) Q1-2089:

It is possible to downsize without notching by cutting the distal femur in:

1) 5Â° varus
3) 3Â° flexion
2) 5Â° valgus
5) 3Â° extension
4) 10Â° flexion

The normal trochlear flange of most components diverges approximately 3Â°. Therefore, if one recuts the distal femur in slight (3Â°) flexion, then, because the trochlear now diverges 6Â°, one can use a smaller component.Correct Answer: 3Â° flexion

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137. (1694) Q1-2090:

The consequence of flexing the femoral component of a posterior cruciate-retaining system is:

1) Flexion contracture
3) Extension contracture
2) Flexion gap
5) No consequences
4) Decreased range of motion

There are no consequences of slightly flexing the femoral component in most cruciate-retaining systems because most prosthetic designs allow for hyperextension of the articulating surfaces. This is not the case with posterior cruciate-substituting systems.Correct Answer: No consequences

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138. (1695) Q1-2091:

Mathematical modeling shows that a round stem versus a rectangular stem in the mid and distal cross-section can increase cement stress up to:

1) 50%
3) 150%
2) 100%
5) 250%
4) 200%

Mathematical modeling of cement stress predicted that a stem with a circular cross-sectional geometry transmits stresses to the cement mantle up to three times greater than stems with a rectangular cross-section.Correct Answer: 250%

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139. (1696) Q1-2092:

Place the following strategies for treating deep infection in total hip replacement in order of their effectiveness from 1 to 4, with 1 being the most effective. 1. No antibiotics 2. Systemic antibiotics alone 3. Antibiotic bone cement alone 4. Antibiotic bone cement plus systemic antibiotics

1) 1,2,3,4
3) 4,2,3,1
2) 2,4,3,1
5) 4,3,2,1
4) 3,2,4,1

According to Espehaug and colleagues in their assessment of 10,905 primary cemented total knee replacements, the most effective strategy is antibiotic-bone cement plus systemic antibiotics followed by systemic antibiotics alone, antibiotic-bone cement alone, and no antibiotics.Correct Answer: 4,2,3,1

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140. (1697) Q1-2093:

Which of the following bone cements is associated with the lowest risk ratio in assessing the risk of deep infection in revision total hip replacement:

1) Simplex (Howmedica, Allendale, NJ) bone cement
3) Palacos bone cement
2) Palacos gentamicin bone cement
5) Vancomycin in bone cement
4) CMW bone cement

According to Malchau and colleagues, Palacos gentamicin bone cement is associated with the lowest risk ratio for revision total hip replacement. Adding other antibiotics are not as effective as Palacos with gentamicin.Correct Answer: Palacos gentamicin bone cement

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141. (1698) Q1-2094:

A midline skin incision is the preferred skin incision in total knee replacement because:

1) A midline skin incision is less disruptive of the arterial network.
3) A midline skin incision gives better exposure.
2) A midline skin incision is less disruptive of the sensory nerves.
5) A midline skin incision is less disruptive of the lymphatic system.
4) A midline skin incision preserves the extensor mechanism.

The blood supply arises from the terminal branches of the peripatellar anastomotic arterial ring and a midline skin incision is the least disruptive to the arterial network. This results in better wound healing and, therefore, less chance for an infection.Correct Answer: A midline skin incision is less disruptive of the arterial network.

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142. (1699) Q1-2095:

When performing a total knee replacement, posterior stability can be achieved by all of the following except:

1) Soft tissue
3) Retention of posterior cruciate ligament
2) The implant
5) Resection of the anterior cruciate ligament
4) Resection of the posterior cruciate ligament

Posterior stability can be achieved through the soft tissues or the implant. The posterior cruciate ligament can be retained and posterior instability can still be achieved. The anterior cruciate ligament plays no role in posterior stability and is always resected during a total knee replacement.Correct Answer: Resection of the posterior cruciate ligament

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143. (1700) Q1-2096:

Recurrent hemarthrosis of the knee following total knee replacement may be secondary to all of the following except:

1) Entrapment of the synovium between the tibiofemoral articulation
3) A lax knee
2) Entrapment of the fat pad between the tibiofemoral articulation
5) Contracted knee
4) Entrapment of the synovium between the patellofemoral articulation

Entrapment of synovium or the fat pad between the tibiofemoral and patellofemoral articulation, and a lax knee have been associated with hemarthrosis following total knee replacement and can be treated by synovectomy or by inserting a thicker component.Correct Answer: Contracted knee

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144. (1701) Q1-2097:

After total knee replacement, posterolateral knee pain is due to all of the following except:

1) Component overhang
3) Posterolateral osteophytes
2) Scarring, more commonly seen in a valgus knee
5) Popliteus tendonitis
4) Undersized component

Component overhang, scarring, and posterolateral osteophytes can cause popliteal impingement and a persistent synovitis resulting in popliteus tendinitis and posterolateral pain. An undersized component may present some other problems but not posterolateral knee pain.Correct Answer: Undersized component

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145. (1702) Q1-2098:

Pes anserine bursitis that occurs after total knee replacement can be associated with all of the following except:

1) Anteromedial overhang of the component
3) Inadequate removal of medial osteophytes
2) Residual varus alignment
5) Anterolateral overhang of the component
4) Pes anserine bursitis is an idiopathic occurrence and not related to total knee replacement

Pes anserine bursitis is usually associated with anteromedial component overhang with residual varus alignment or inadequate removal of medial osteophytes.Correct Answer: Anterolateral overhang of the component

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146. (1703) Q1-2099:

All of the following statements are true regarding the Bernese osteotomy except:

1) The Bernese osteotomy was popularized by Ganz.
3) The Bernese osteotomy allows for unrestricted correction while keeping the pelvic ring intact.
2) The Bernese osteotomy is a reorientation osteotomy.
5) The Bernese osteotomy can be used only in anteverted dysplastic hips.
4) The Bernese osteotomy can be used in approximately 15% of dysplastic hips.

The Bernese periacetabular osteotomy, which was popularized by Ganz, is a reorientation osteotomy that allows for unrestrained correction while keeping the pelvic ring intact and can be used in approximately 17% of dysplastic hips. The Bernese osteotomy can be used in anteverted and retroverted dysplastic hips.Correct Answer: The Bernese osteotomy can be used only in anteverted dysplastic hips.

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147. (1704) Q1-2100:

The two most commonly used scoring techniques to assess and report the results of knee arthroplasty are the Hospital for Special Surgery knee score and the Knee Society score. Although they are the most commonly used scoring techniques, their main weakness is:

1) Examiner and intraobserver bias
3) Based on questionairre completed by the patient
2) Can only be used in patients with osteoarthritic knees
5) Has no intervention of a health care provider
4) Derived from patient outcomes

The Hospital for Special Surgery knee score and the Knee Society score have examiner and intraobserver bias. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score is based on a questionnaire completed by the patient and is derived from patient outcomes without intervention of a healthcare provider.Correct Answer: Examiner and intraobserver bias

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148. (1705) Q1-2101:

Which of the following scoring techniques is the weakest when used to compare specific physical dynamics of a prosthesis:

1) Hospital for Special Surgery knee score
3) Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score
2) Knee Society score
5) Mayo Clinic knee score
4) Iowa knee score

The Hospital for Special Surgery knee score and the Knee Society score provide more detailed information about the physical dynamics of a prosthesis than the WOMAC score. A combination of the three scores correlate well in their measurement of total knee replacement outcomes.Correct Answer: Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) score

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149. (1706) Q1-2102:

What percentage of nonsteroidal anti-inflammatory drug (NSAID) users annually develop a serious gastrointestinal (GI) complication:

1) 2%
3) 10%
2) 4%
5) 20%
4) 15%

Annually, 1% to 2% of NSAID users develop a serious GI complication. The risk of bleeding, perforation, hospitalization, or death is three times higher among NSAID users than non-NSAID users.Correct Answer: 2%

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150. (1707) Q1-2103:

Nonsteroidal anti-inflammatory drugs (NSAIDs) work by:

1) Inhibiting the conversion of arachidonic acid to prostaglandin
3) Increasing the level of prostaglandin in the joint
2) Increasing prostaglandin synthesis
5) Decreasing glycosaminoglycan synthesis
4) Increasing glycosaminoglycan synthesis

Prostaglandins are the key components of the inflammatory process and work by inhibiting the conversion of arachidonic acid to prostaglandin.Correct Answer: Inhibiting the conversion of arachidonic acid to prostaglandin

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151. (1708) Q1-2104:

Cyclooxygenase (Cox-1) is found:

1) Only in the gastrointestinal tract
3) Only in the platelets
2) Only in the kidneys
5) Widely expressed throughout the body
4) Only in the articular cartilage

Cox-1 is the ubiquitous form of the cyclooxygenase enzyme that is widely expressed throughout the body. Cox-1 is not found in only one specific organ.Correct Answer: Widely expressed throughout the body

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152. (1709) Q1-2105:

Steroid injections work in osteoarthritic joints by the following mechanism:

1) Increasing phagocytes
3) Increasing synthesis of inflammatory mediators
2) Inhibiting lysosomal enzyme release
5) Stabilizing synthesis of inflammatory mediators
4) Stabilizing phagocytes

Steroids work by inhibiting lysosomal enzyme release, decreasing phagocytes, and decreasing the synthesis of inflammatory mediators.Correct Answer: Inhibiting lysosomal enzyme release

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153. (1710) Q1-2106:

Intra-articular steroids decrease the synthesis of prostaglandin and interleukin-1 by:

1) 90%
3) 30%
2) 20%
5) 70%
4) 50%

Intra-articular steroids decrease the synthesis of prostaglandin and interleukin-1 by as much as 50%.Correct Answer: 50%

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154. (1711) Q1-2107:

Intra-articular steroids change synovial fluid characteristincs by:

1) Stabilizing phagocytes
3) Increasing the hyaluronic acid concentration in a joint
2) Stabilizing synthesis of inflammatory mediators
5) Intra-articular steroids do not change synovial fluid characteristics
4) Decreasing the hyaluronic acid concentration in a joint

Intra-articular steroids change synovial fluid characteristics by increasing hyaluronic acid concentration.Correct Answer: Increasing the hyaluronic acid concentration in a joint

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155. (1712) Q1-2108:

To reduce the chance of irritation when injecting a knee with hyaluronic acid, which of the following approaches is recommended:

1) A medial approach in a partially bent knee
3) A direct lateral injection
2) A direct straight injection
5) A direct injection through the patellar tendon
4) A medial approach in an extended knee

The chance of an injection site irritation is 5.2% with a medial approach in a partially bent knee, 2.4% with a straight injection, and 1.5% with a direct lateral approach. There is also an increased chance of irritation with a direct patellar tendon injection.Correct Answer: A direct lateral injection

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156. (1713) Q1-2109:

Indications for high tibial osteotomy include all of the following except:

1) 10Â° to 15Â° of varus deformity on weight-bearing radiographs
3) Flexion contracture less than 15Â°
2) 90Â° preoperative range of motion
5) Age younger than 60 years
4) 60Â° preoperative range of motion

Indications for a high tibial osteotomy include age younger than 60 years, 10Â° to 15Â° varus deformity, 90Â° preoperative arc range of motion, and flexion contracture less than 15Â°.Correct Answer: 60Â° preoperative range of motion

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157. (1714) Q1-2110:

Contraindications to high tibial osteotomy include:

1) Lateral compartment narrowing
3) Medial compartment bone loss of more than 3 mm
2) Lateral tibial subluxation more than 1 cm
5) All of the above
4) Ligament instability

Lateral compartment narrowing, lateral tibial subluxation of more than 1 cm, medial compartment bone loss of more than 3 mm, and ligament instability are contraindications to high tibial osteotomy.Correct Answer: All of the above

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158. (1715) Q1-2111:

The incidence of lateral gonarthrosis in women is:

1) Lower than men
3) Two times higher in women
2) Same as men
5) Five times higher in women
4) Three times higher in women

The incidence of primary lateral gonarthrosis in women is five times higher than in men, and the average age of patients is 55 to 60 years. The body habitus of women tend to align more weight on the lateral compartment when compared to men.Correct Answer: Five times higher in women

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159. (1716) Q1-2112:

The majority of patients with lateral compartment arthritis have:

1) Rheumatoid arthritis
3) Collagen vascular disease
2) Neurologic condition (e.g., Polio)
5) Trauma
4) Osteoarthritis

Rheumatoid arthritis usually involves the lateral compartment because it is a bicompartmental disease. Although most patients with osteoarthritis have medial compartment arthritis, they still have a significant higher incidence of lateral arthritis than any other disease. The incidence of lateral compartment arthritis is lower in trauma, collagen vascular disease, or patients with neurologic conditions like polio.Correct Answer: Osteoarthritis

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160. (1717) Q1-2113:

Which of the following is not a good indication for a varus-producing supracondylar femoral osteotomy (SFO):

1) Valgus deformity less than 15Â°
3) 90Â° arc of range of motion
2) Valgus joint-line tilt more than 10Â°
5) Young patients
4) Old patients

Varus producing supracondylar femoral osteotomy is indicated for a valgus deformity less than 15Â°, valgus joint line tilt more than 10Â° in a patient with at least a 90Â° arc of motion. The procedure is also best indicated in stout, young patients who are involved in heavy labor jobs.Correct Answer: Old patients

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161. (1718) Q1-2114:

When performing a supracondylar femoral osteotomy, it is recommended to correct the tibiofemoral angle:

1) 2Â°
3) 4Â° to 6Â°
2) 2Â° to 4Â°
5) More than 8Â°
4) 6Â° to 8Â°

Correcting the tibiofemoral angle between 4Â° to 6Â° transfers 80% of the weight to the medial angle.Correct Answer: 4Â° to 6Â°

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162. (1719) Q1-2115:

The most common problem encountered with total knee arthroplasty (TKA) after high tibial osteotomy is:

1) Offset of tibial plateau from tibial shaft
3) Dealing with skin incision
2) Patella infera
5) High riding patella
4) Tracking of patella

Patella infera is encountered 80% of the time after a high tibial osteotomy. Patella infera makes it difficult for a surgeon to visualize and dislocate the patella laterally, and it also makes for a difficult salvage for a total knee replacement.Correct Answer: Patella infera

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163. (1720) Q1-2116:

When careful evaluation after primary total knee arthroplasty (TKA) is performed, the results of TKA after previous high tibial osteotomy (HTO) have a Knee Society good-to-excellent score what percentage of the time:

1) 20%
3) 60%
2) 40%
5) 90%
4) 80%

Primary TKA with respect to Knee Society scores and operative complications shows that a primary TKA group scored 88% good to excellent results compared to 63% for the post-HTO group.Correct Answer: 60%

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164. (1721) Q1-2117:

Subchondral drilling for cartilage defects is effective for:

1) Varus alignment
3) Subchondral sclerosis
2) Valgus alignment
5) Rheumatoid arthritis
4) Fibrocartilage formation

Subchondral drilling allows the blood supply to form clot-containing stem cells from which fibrocartilage forms. It is not indicated in patients with systemic disease like rheumatoid arthritis. It is ineffective for varus or valgus alignment or subchondral sclerosis.Correct Answer: Fibrocartilage formation

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165. (1722) Q1-2118:

When performing a mosaicplasty for cartilage defects, the defects must be:

1) Less than 1 cm
3) Less than 2 cm
2) Less than 1.5 cm
5) Less than 3 cm
4) Less than 2.5 cm

When performing a mosaicplasty for cartilage defects, the best results are obtained with defects less than 2 cm. The plugs should measure 2.5 mm in length. Mosaicplasty results for defects larger than 2 cm have not been as gratifying.Correct Answer: Less than 2 cm

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166. (1723) Q1-2119:

Mobile-bearing total knee replacement (TKR) implants are designed to have how many articulations:

1) 0
3) 2
2) 1
5) 4
4) 3

Mobile-bearing TKR implants are designed to have two articulations, one between the femoral and tibial component and the other between the tibial component and base plate on the tibia.Correct Answer: 2

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167. (1724) Q1-2120:

After 5 years, cemented all-polyethylene components in total knee replacement have a loosening rate of:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

At 5 years, cemented all-polyethylene tibial components in total knee replacement have a loosening rate of 20%. A loosening rate of 20% is unacceptable, therefore, cemented all-polyethylene tibial components are no longer used in total knee replacements. New all poly tibial components are presently being investigated, but not for general use presently.Correct Answer: 20%

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168. (1725) Q1-2121:

When performing a total knee replacement (TKR) on a patient with previous skin incisions on the knee, if a different skin incision is to be made it is recommended that the distance between the incisions should be:

1) 2 cm
3) 4 cm
2) 3 cm
5) 7 cm
4) 5 cm

Most authors recommend a 7-cm distance between skin incisions. If the distance between the incisions is less than 7 cm, then the chance of skin slough increases.Correct Answer: 7 cm

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169. (1726) Q1-2122:

The medial parapatellar skin incision for total knee replacement (TKR):

1) Limits lateral side exposure and interferes with the blood supply of the lateral skin flap
3) Makes the lateral skin flap smaller
2) Necessitates a lateral release
5) Provides excellent exposure for a TKR
4) Increases the blood supply to the patella

The medial parapatellar skin incision limits exposure of the lateral compartment and interferes with the blood supply of the lateral skin flap.Correct Answer: Limits lateral side exposure and interferes with the blood supply of the lateral skin flap

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170. (1727) Q1-2123:

Which of the following is not true regarding a subvastus arthrotomy for total knee replacement (TKR):

1) A lift of the entire quadriceps mechanism
3) A danger of causing injury to the femoral artery
2) A poor exposure of the lateral aspect of the knee joint
5) Provides good visualization in an obese patient
4) Provides fair exposure in a thin patient

All of the answers are associated with the subvastus arthrotomy. A subvastus arthrotomy is a particularly difficult approach in obtaining visualization in an obese patient.Correct Answer: Provides good visualization in an obese patient

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171. (1728) Q1-2124:

Which of the following is a true statement concerning the quadriceps snip technique:

1) The quadriceps snip technique involves lengthening the tendon in a
3) The quadriceps snip technique significantly weakens the extensor tendon.
2) The quadriceps snip technique enters the quadriceps tendon with a
5) The quadriceps snip technique involves a horizontal cut in the extensor tendon.
4) The quadriceps snip technique permits extended exposure.

The quadriceps snip technique entails dividing the tendon proximally in an oblique fashion to permit extended exposure.Correct Answer: The quadriceps snip technique permits extended exposure.

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172. (1729) Q1-2125:

Which of the following is a true statement regarding intramedullary instrumentation when performing bone cuts in total knee replacement (TKR):

1) Intramedullary instrumentation is equally as accurate as extramedullary devices in all knees.
3) Intramedullary instrumentation is less accurate than extramedullary devices in valgus knees.
2) Intramedullary instrumentation is less accurate than extramedullary devices in varus knees.
5) Intramedullary instrumentation is more accurate than extramedullary devices in valgus knees.
4) Intramedullary instrumentation is more accurate than extramedullary devices in varus knees.

Valgus in the tibia shaft may be up to 70%, and intramedullary rods cannot be fully placed into the tibia. Extramedullary techniques are recommended.Correct Answer: Intramedullary instrumentation is less accurate than extramedullary devices in valgus knees.

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173. (1730) Q1-2126:

When total knee replacement surgery is complete, the alignment of the knee must be:

1) Neutral
3) 5Â° of valgus in the femur
2) 2Â° of valgus in the tibia
5) 7Â° of valgus in the femur
4) 7Â° of valgus in the tibia

The tibial cut is perpendicular to the tibial axis, the femoral cut is made in 4Â° to 6Â° valgus, and the knee aligned in 4Â° to 6Â° of valgus provided the ligaments are balanced.Correct Answer: 5Â° of valgus in the femur

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174. (1731) Q1-2127:

Overall objectives in total knee replacement (TKR) should include all of the following except:

1) Valgus aligned knee
3) Midline tracking patella
2) Range of motion 0Â° to 125Â°
5) Neutral aligned knee
4) Collateral ligament balance at full extension and 90Â°

To have a satisfactory alignment one should have a valgus aligned knee, not a neutral aligned knee. Range of motion should be 0Â° to 125Â° with midline tracking patella. The collateral ligament should be balanced at full extension an 90Â°.Correct Answer: Neutral aligned knee

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175. (1732) Q1-2128:

What is the measured resection technique when performing a total knee replacement:

1) Removes 20% more bone than cut
3) Entails ligament balancing in extension
2) Removes an exact amount of bone to fit in the prosthetic device
5) Incorporates ligament balancing in flexion and extension
4) Entails ligament balancing in flexion

The measured resection technique is a philosophy that removes the exact amount of bone necessary to fit in the prosthetic device for the femur and tibia, and does not detail ligament balancing. The flexion-extension gap technique incorporates ligament balancing with the bony cuts that give equal flexion and extension gaps.Correct Answer: Removes an exact amount of bone to fit in the prosthetic device

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176. (1733) Q1-2129:

When performing a total knee replacement, if you discover that the gap in flexion is larger than the gap in full extension, you should:

1) Remove more bone from the tibia
3) Remove more bone from the femur in extension
2) Remove more bone from the femur in flexion
5) Put in a posterior stabilized prosthesis
4) Remove more bone from the posterior femur

By removing more bone from the femur in extension and using a higher polyethylene component, the flexion and extension gaps can be equalized. If this does not correct the problem, then one should proceed to a posterior stabilized prosthesis.Correct Answer: Remove more bone from the femur in extension

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177. (1734) Q1-2130:

When performing a total knee replacement, if you discover that the gap in flexion is smaller than the gap in extension:

1) More bone should be removed from the femur in extension
3) More bone should be removed from the posterior femur
2) A larger polyehtylene component should be used
5) A smaller polyethylene component should be used
4) The femoral component should be upsized

If the flexion gap is smaller than the extension gap, the knee should be balanced by removing more posterior bone from the femur or downsizing the femoral component.Correct Answer: More bone should be removed from the posterior femur

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178. (1735) Q1-2131:

Which of the following can lead to patellar dislocation in total knee replacement:

1) Internal rotation of femoral component
3) Too large a femoral component
2) External rotation of femoral component
5) Too large a tibial component
4) External rotation of tibial component

Internal rotation of either the femoral or tibial component may lead to patellar dislocation. External rotation of the femoral or tibial component does not usually lead to dislocation, and increased size of the femoral or tibial component will not predispose to patella dislocation.Correct Answer: Internal rotation of femoral component

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179. (1736) Q1-2132:

Epidural analgesia in the postoperative period after total joint replacement is widely used and is associated with all of the following complications except:

1) Nausea
3) Peroneal nerve palsy
2) Respiratory depression
5) Hypotension
4) Femoral nerve palsy

Nausea, hypotension, respiratory depression, and peroneal nerve palsy are associated with epidural analgesia. Be aware of an epidural bleed secondary to anticoagulation efforts for deep venous thrombosis prophylaxis.Correct Answer: Femoral nerve palsy

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180. (1737) Q1-2133:

Painful "clunking" sensations upon active extension from 60Â° to 30Â° in patients with total knee replacements are:

1) Fibrous nodules under patellar tendon
3) Fibrous nodule under distal quadriceps tendon
2) Seen only in posterior-stabilized total knee replacement because of fibrous build up in the nodule
5) Oversized tibial components
4) Seen only in posterior cruciate retaining total knee replacements

This painful clunking sensation from 60Â° to 30Â° is caused by a fibrous nodule under the distal quadriceps tendon. Contributing factors include a large patellar component with proximal overhang and an abrupt change in the radius of curvature of the femoral component that irritates the quadriceps tendon.Correct Answer: Fibrous nodule under distal quadriceps tendon

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181. (1738) Q1-2134:

All of the following are reported advantages of metal-backed patella components except:

1) Metal-backed patella components minimize deformity of overlying polyethylene.
3) Metal-backed patella components allow for cementless fixation.
2) Metal-backed patella components permit more evenly distribution of load transmissions.
5) Metal-backed patella components reduce the polyethylene thickness at the periphery of the implant.
4) Metal-backed patella components increase deformity of the overlying polyethylene.

Metal-backed patella components minimize deformity of the overlying polyethylene and do not increase deformity. These components enable an even distribution of load transmissions and reduce the polyethylene thickness at the periphery of the implant. Metal-backed patella components also allow for cementless fixation of the patellae component.Correct Answer: Metal-backed patella components increase deformity of the overlying polyethylene.

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182. (1739) Q1-2135:

Failure modes of metal-backed patella designs include all of the following except:

1) Dissociation of polyethylene and metal plate
3) Femoral component exposed to the metal of the patella component
2) Component fractures
5) Metallic synovitis
4) Increased risk of patella dislocation

The polyethylene wear exposing the metal to wear against the femoral component is the ultimate result of all of the above failure modes except increased patella dislocation.Correct Answer: Increased risk of patella dislocation

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183. (1740) Q1-2136:

The incidence of patella component loosening is:

1) 4%
3) 2%
2) 10%
5) 15%
4) 8%

The incidence of patella component loosening is less than 2%. Factors predisposing to loosening include cementation into deficient bone, component malposition, patellar subluxation or fracture, patellar avascular necrosis, asymmetric patellar bone resection, and loosening of other components. Treatment options include observation, component revision, patellectomy or component removal, and patellar arthroplasty if bone stock is sufficient.Correct Answer: 2%

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184. (1741) Q1-2137:

The preferred means for fixation of patellar components is:

1) Large, central patellar lugs
3) Three large patellar-fixation lugs
2) Two parallel patellar lugs
5) One central and two peripheral-fixation lugs
4) Three small peripheral-fixation lugs

Large, central patellar-fixation lugs remove a significant amount of bone, which contributes to patellar fractures. Three small peripheral-fixation lugs are preferred in most designs.Correct Answer: Three small peripheral-fixation lugs

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185. (1742) Q1-2138:

The majority of patellofemoral instability cases are secondary to:

1) Trauma
3) Surgical technique
2) Failure to perform a lateral release
5) Patient related
4) Prosthetic design

Trauma, failure to perform a lateral release, and prosthetic design are associated with patellofemoral instability, but the majority of patellofemoral instability cases are secondary to errors in surgical judgement and technique.Correct Answer: Surgical technique

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186. (1743) Q1-2139:

Which of the following conditions related to the femur does not influence patellofemoral mechanics and stability:

1) Selecting an oversized femoral component
3) Medial positioning of the femoral component
2) Improper femoral component rotation
5) Excessive flexion gap
4) Excessive axial valgus alignment

The femoral component size, rotation, position, and alignment influence patellofemoral mechanics. For instance, an oversized femoral component leads to "overstuffing" that results in decreased flexion of the knee. Excessive flexion gap does not influence patellofemoral mechanics.Correct Answer: Excessive flexion gap

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187. (1744) Q1-2140:

The position of the tibial component influences patellar biomechanics. The best position to place the component is:

1) Internal rotation of the tibial component
3) Medialization of tibial component
2) External rotation of the tibial component
5) External rotation and lateralization
4) Lateralization of tibial component

The tibial component must be positioned in external rotation and lateralized when possible. Internal rotation or medialization predispose to patellar subluxation.Correct Answer: External rotation and lateralization

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188. (1745) Q1-2141:

Which of the following is not a risk factor for fracture of the distal femur proximal to total knee replacement (TKR):

1) Rheumatoid arthritis and osteopenia
3) Osteoarthritis
2) Anterior femoral notching
5) Revision arthroplasty
4) Steroid use

The risk factors associated with fracture of the distal femur proximal to TKR are anterior femoral notching (especially if more than 3 mm in depth), rheumatoid arthritis, steroid use, osteopenia, revision arthroplasty, neuromuscular disorders, stiff knee, or poor flexion of the TKR.Correct Answer: Osteoarthritis

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189. (1746) Q1-2142:

Risk factors for peroneal nerve palsy after total knee replacement (TKR) include all of the following except:

1) Severe valgus deformity
3) Epidural anethesia
2) Flexion contracture
5) Increased flexion gap
4) Previous lumbar laminectomy and valgus osteotomy

Severe valgus deformity, flexion contracture, and epidural anesthesia are risk factors associated with peroneal nerve palsy following TKR. Previous lumbar laminectomy and previous valgus osteotomy of the tibia also increase a patientâs chance of peroneal nerve palsy.Correct Answer: Increased flexion gap

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190. (1747) Q1-2144:

The most common cause of stiffness after total knee replacement (TKR) is:

1) Implant selection
3) Flexion contracture of the contralateral extremity
2) Poor preoperative range of motion
5) Tight posterior cruciate ligament (PCL) after implanting a PCL-retaining knee
4) A large spacer

Poor preoperative range of motion is the main cause of stiffness after TKR.Correct Answer: Poor preoperative range of motion

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191. (1748) Q1-2145:

The femoral component can be malaligned in how many different directions:

1) 1
3) 4
2) 2
5) 8
4) 6

The femoral component can be malaligned in one of eight different directions.Correct Answer: 8

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192. (1749) Q1-2146:

What size tibial insert is associated with easy failure and accelerated osteolysis:

1) 6 mm
3) 10 mm
2) 8 mm
5) 15 mm
4) 12 mm

Inserts thinner than 6 mm are associated with easy failure and osteolysis, caused by fracture and wear of the polyethylene.Correct Answer: 6 mm

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193. (1750) Q1-2147:

Which of the following tests helps in the diagnosis of reflex sympathetic dystrophy:

1) Magnetic resonance imaging
3) Bone scanning
2) Computerized tomography scanning
5) Tomography
4) Ultrasonography

Usually, reflex sympathetic dystrophy is a diagnosis of exclusion characterized by a syndrome of pain out of proportion to the clinical findings; a bone scan may demonstrate increased uptake in the affected area.Correct Answer: Bone scanning

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194. (1751) Q1-2148:

Erythema, warmth, stiffness, and cutaneous hypersensitivity after total knee replacement associated with pain is usually caused by:

1) Infection
3) Gout
2) Reflex sympathetic dystrophy
5) Vascular insufficiency
4) Patellar malalignment

These symptoms, in addition to pain out of proportion to clinical findings, characterize a slow postoperative course. Poor function after total knee replacement is usually secondary to reflex sympathetic dystrophy.Correct Answer: Reflex sympathetic dystrophy

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195. (1752) Q1-2149:

Aspirating synovial fluid prior to total knee replacement revision surgery after ensuring that a patient is not concurrently on antibiotic therapy has a sensitivity, specificity, and accuracy of:

1) 20% to 40%
3) Less than 20%
2) 60% to 80%
5) 90% to 100%
4) 40% to 60%

Providing the patient is off antibiotics, the sensitivity, specificity, and accuracy of snynovial fluid aspiration is 100%. Antibiotic administration before or during the aspiration will mask the analysis.Correct Answer: 90% to 100%

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196. (4048) Q1-2187:

The principal thrombogenic stimulus that leads to the production of venous thromboembolic disease during total hip arthroplasty occurs:

1) During the induction of anesthesia
3) 12 hours postoperative
2) During the preparation of the femoral canal
5) 7 days postoperative
4) 24 hours postoperative

The process of thrombosis starts during the preparation of the femoral canal. Elevation in thrombogenic factors is most pronounced during preparation of the femoral canal, especially with insertion of a cemented femoral component. Mechanical manipulation of the limb (dislocation of the femoral head) may also cause intimal damage or occlusion of the femoral vein.Correct Answer: During the preparation of the femoral canal

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197. (1789) Q1-2188:

Place the following in the correct order of increasing modulus of elasticity (least to greatest):

1) Cobalt-chrome, titanium, compact bone, stainless steel
3) Compact bone, titanium, cobalt-chrome, stainless steel
2) Titanium, compact bone, cobalt-chrome, stainless steel
5) Titanium, compact bone, stainless steel, cobalt-chrome
4) Compact bone, titanium, stainless steel, cobalt-chrome

Modulus of elasticities are as follows in Gpa (psi $3\ 10^6$):

Compact bone: 21 (3)
Titanium: 96 (14)
Stainless steel: 193 (28)
Cobalt-chrome: 235 (34)

Correct Answer: Compact bone, titanium, stainless steel, cobalt-chrome

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198. (1790) Q1-2189:

Which of the following precautionary measures should be taken to prevent a periprosthetic fracture when removing components from a patient with a previous compression hip screw:

1) Cemented femoral component with cement augmentation of the screw holes and full weight bearing
3) Toe touch weight bearing for 6 weeks
2) Plate augmentation with circlage wires and protected weight bearing
5) Bypass the last screw hole with a cemented femoral component by two cortical diameters and protected weight bearing
4) Cortical strut allograft and protected weight bearing

Stress risers are generated when a screw is removed from the femur, weakening the bone for at least 4 weeks. Larger defects (50%) of the cortical width can reduce torsional strength up to 44%. Bypassing the defect by two cortical diameters with a cemented stem doubles the boneâs strength.Correct Answer: Bypass the last screw hole with a cemented femoral component by two cortical diameters and protected weight bearing

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199. (1791) Q1-2190:

Which of the following radiographic changes is apparent after placement of a fully porous-coated, cobalt-chrome femoral stem:

1) Proximal-femoral osteopenia
3) Radiolucency around the acetabular cup
2) Distal-femoral osteopenia
5) Osteopenia adjacent to the entire femoral component
4) Increased mineralization proximally

The most severe stress shielding occurs with an extensively porous-coated chrome-cobalt stem. Stress shielding occurs as the load is transferred from the hip joint to the proximal femur. The load that was previously carried by the hip joint is now shared with the implant. This change leads to remodeling of the proximal femur, resulting in a decreased density and thinning of the proximal portion of the femur. In a group of patients characterized as having severe stress-shielding based on plain radiographs, no adverse effects were noted in terms of hip scores, presence of osteolysis, or need for revision.Correct Answer: Proximal-femoral osteopenia

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200. (1792) Q1-2191:

Noncircumferential-porous coating leads to which of the following adverse effects:

1) Increased rates of infection
3) Increased rates of distal osteolysis and late femoral loosening
2) Increased rates of stress shielding
5) Increase rates of thigh pain
4) Increase rates of thigh pain

Noncircumferential-porous coating allows a pathway for particulate debris (polywear) to the distal part of the stem, promoting osteolysis. The polyethylene wear debris migrates through the pathway promoting osteolysis and, ultimately, failure.Correct Answer: Increased rates of distal osteolysis and late femoral loosening

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201. (1793) Q1-2192:

The best position for hip arthrodesis is:

1) Neutral abduction/adduction, 20Â° to 30Â° flexion, and neutral internal/external rotation
3) Neutral abduction/adduction, full extension, and neutral internal/external rotation
2) Neutral abduction/adduction, full extension, and neutral internal/external rotation
5) 10Â° abduction, 20Â° to 30Â° flexion, neutral internal/external rotation
4) Neutral abduction/adduction, 15Â° to 20Â° flexion, and neutral internal/external rotation

The favored position of hip arthrodesis is 20Â° to 30Â° flexion, neutral (or minimal adduction) adduction/abduction, and neutral internal/external rotation (can be slight external rotation). Insufficient flexion makes sitting difficult, while too much flexion makes standing difficult due to increased lumbar lordosis. Abduction and internal rotation should be avoided.Correct Answer: Neutral abduction/adduction, 20Â° to 30Â° flexion, and neutral internal/external rotation

---

202. (1794) Q1-2193:

Which of the following total hip arthroplasty (THA) positions increases the chances of an anterior dislocation:

1) Flexion, adduction, and internal rotation
3) Extension, adduction, and external rotation
2) Flexion, abduction, and internal rotation
5) Extension, abduction, and internal rotation
4) Extension, adduction, and internal rotation

The most common direction for THA dislocation is posterior. Dislocation may be associated with a posterior approach, poor technique, or previous surgery. Posterior dislocations are accentuated by placing the hip in flexion, adduction, and internal rotation (i.e., rising from a low-seated chair). Less common anterior dislocations occur after an anterior approach or with anteversion of the cup or femoral component (or both). The position for dislocation is accentuated by extension, adduction, and external rotation.Correct Answer: Extension, adduction, and external rotation

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203. (1795) Q1-2194:

Loosening of a cemented metal-backed polyethylene acetabular component occurs at which of the following junctions:

1) The cement-bone interface
3) The metal-polyethylene interface as a result of micromotion
2) The cement-metal interface
5) Both the cement-bone and cement-metal interface
4) Result of fracture and dissolution through the structure of the cement

Autopsy studies show that the loosening of cemented components occurs at the cement-bone interface. Loosening occurs first at the periphery and proceeds toward the dome. The bone resorption at the cement-bone interface is a response to polyethylene debris.Correct Answer: The cement-bone interface

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204. (1796) Q1-2195:

Placing a screw in the anterior-superior quadrant of the acetabulum places which of the following structures at-risk:

1) External iliac vein
3) Bladder
2) Internal iliac artery
5) Common iliac artery
4) Obturator vein

Placing screws in the acetabular cup in the anterior-superior or anterior-inferior quadrant is not advised due to the proximity of the external iliac vein and the obturator artery, respectively.Correct Answer: External iliac vein

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205. (1797) Q1-2196:

During revision surgery for total hip arthroplasty, the accepted standard for the presence of an infection on frozen tissue histological analysis is:

1) Five mononuclear cells per high-powered field
3) Five polymorphonuclear cells per high-powered field
2) Ten mononuclear cells per high-powered field
5) One polymorphonuclear cell per high-powered field
4) Ten polymorphonuclear cells per high-powered field

Frozen section analysis is important in revision surgery to determine why a component has become loose. Ten polymorphonuclear cells per high-powered field lower the sensitivity for infection but do not reduce the specificity to diagnose an infection. Five polymorphonuclear cells per high-powered field are the current standard accepted as diagnostic for an infection. Mononuclear cells can be present in the face of aseptic loosening or polywear disease. Polymorphonuclear cells are diagnostic of biologic infectious response.Correct Answer: Five polymorphonuclear cells per high-powered field

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206. (1798) Q1-2197:

Which of the following is not an indication for an intertrochanteric osteotomy:

1) Malunion of a fracture in the trochanter region
3) Avascular necrosis involving more than 50% of the femoral head
2) Shortening, lengthening, or derotation osteotomies to realign the extremity
5) Avascular necrosis involving less than 25% of the femoral head
4) Avascular necrosis involving less than 50% of the femoral head

Malunion fractures in the trochanter region and shortening, lengthening, or derotation osteotomies to realign the extremity are indications for an intertrochanteric osteotomy. Avascular necrosis involving more than 50% of the femoral head is a contraindication for intertrochanteric osteotomy.Correct Answer: Avascular necrosis involving more than 50% of the femoral head

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207. (1799) Q1-2198:

Normal activities, such as walking 1 km/hour, create forces across the hip joint of _____ times body weight:

1) 1
3) 3
2) 2
5) 5
4) 4

Normal activities increase forces over the hip to three times body weight. Jogging increases forces across the hip by five to eight times body weight.Correct Answer: 3

---

208. (1800) Q1-2199:

The principles of osteotomy do not include which of the following:

1) Improving congruency by restoring proper biomechanics
3) Timely intervention with minimal arthrosis
2) Reorienting the weight bearing surfaces to transfer load in compression rather than shear
5) Bone-to-bone aposition
4) Advanced osteoarthritis

Principles of osteotomy include improving congruency by restoring proper mechanics, reorienting the weight bearing surfaces to transfer load in compression rather than shear, bone-to-bone aposition, and timely intervention with minimal arthrosis.Correct Answer: Advanced osteoarthritis

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209. (1801) Q1-2200:

The technical goals of osteotomy should include all of the following except:

1) Eliminating impingement
3) Sacrificing motion
2) Correcting deformity
5) Altering range of motion
4) Restoring pain-free functional range of motion

Technical goals of osteotomy include eliminating impingement, correcting deformity, and restoring a pain-free functional range of motion. Motion should not be gained or lost, but the range can be altered.Correct Answer: Sacrificing motion

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210. (1802) Q1-2202:

The best index to measure acetabular deficiency in the coronal plane is:

1) Tear drop ratio
3) Hilgenreiner angle
2) Center edge angle of Wiberg
5) Greater trochanter-pubic ratio
4) Leg length measurements

Literature from Europe and North America suggests that a patient with acetabular dysplasia whose anteroposterior radiograph shows a center edge angle of Wiberg less than 15Â° is a good candidate for periacetabular osteotomy.Correct Answer: Center edge angle of Wiberg

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211. (1803) Q1-2203:

In cemented total hip arthroplasty, the initial event in the loosening process of the femoral component occurs at the:

1) Bone-cement interface
3) Thin cement mantle with fatigue fractures of cement
2) Prosthesis-cement interface
5) Large cement mantles
4) Simultaneously at the bone cement and prosthesis cement interface

From the long-term observations of radiograph changes occurring around well-performed cemented total hip arthroplasties, fatigue fracture of cement, especially in areas of thin cement mantles, leads to loss of stability of the femoral component within the cement mantle.Correct Answer: Thin cement mantle with fatigue fractures of cement

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212. (1804) Q1-2204:

Loosening of the acetabular component in a cemented total hip arthroplasty most often occurs at:

1) Bone-cement interface
3) Within the cement
2) Prosthesis-cement interface
5) Within the bone
4) Simultaneously at all three locations

Loosening on the acetabular side most often occurs at the bone-cement interface. Histiocyte cell membrane proliferation incited by particulate generation proceeds from the periphery of the bone-cement interface to the dome of the acetabulum with eventual loosening.Correct Answer: Bone-cement interface

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213. (1805) Q1-2205:

The best fatigue strength for the femoral component is:

1) Coated stainless steel
3) Cold-forged stainless steel
2) Coated chromium cobalt
5) Porous-coated stainless steel
4) Fatigue strength is identical in all

Cold-worked, cold-forged micrograin femoral components provide greater fatigue strength than original casting techniques. Coated stainless steel and coated chromium cobalt have less fatigue strength then the other answer choices.Correct Answer: Cold-forged stainless steel

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214. (1806) Q1-2206:

Femoral components made of which material have the least amount of stiffness:

1) Stainless steel
3) Titanium
2) Chromium cobalt
5) Porous-coated stainless steel
4) All of the above have approximately the same amount of stiffness

Titanium has one-half the material modulus, or stiffness, of chromium cobalt or stainless steel irrespective of the type of porous coating. Titanium also has a high corrosion resistance that is attributed to an oxide layer which is chemically nonreactive to the surrounding tissue.Correct Answer: Titanium

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215. (1807) Q1-2207:

Cement fatigue is the main cause of loosening in a cemented femoral component. Cement is strongest in:

1) Extension
3) Compression
2) Tension
5) Flexion
4) Shear

Cement is stronger in compression than in tension. Stem designs incorporate a taper to the mid and distal stem geometry to transfer the load from the stem to the cement primarily in compression.Correct Answer: Compression

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216. (1808) Q1-2208:

The most durable cemented femoral component design has which of the following surface finishes:

1) RA surface more than 1.5 (average roughness)
3) Matte finish surface
2) Grit-blasted surface
5) None of the above
4) Polished, smooth surface

Femoral components with polished, smooth surfaces and low RA surfaces have proved to be more durable than devices with a rougher finish.Correct Answer: Polished, smooth surface

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217. (1809) Q1-2209:

Noncemented femoral components must be able to resist translation and rotation in all of the following except:

1) Translation in the axial plane
3) Translation in the anteroposterior plane
2) Translation in the medial-lateral plane
5) Pivot shift test
4) Rotation in the coronal plane

Implants must resist translation in the axial, medial-lateral, and anteroposterior planes, as well as resisting rotation in the parasagittal, transverse, and coronal planes.Correct Answer: Pivot shift test

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218. (1810) Q1-2210:

Which uncemented femoral component design provides the best axial and torsional stability in the metaphyses:

1) Single wedge-shaped implant
3) Tapered implant
2) Wedge-shaped metaphyseal-filling implant
5) Diaphyseal-filling implant
4) Extensively porous-coated implant

The metaphysis provides axial and torsional stability for most wedge-shaped, proximally porous-coated, metaphyseal-filling implants. The other types of implants give stability in other areas than the metaphyses.Correct Answer: Wedge-shaped metaphyseal-filling implant

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219. (1811) Q1-2211:

Modularity in noncemented femoral components is popular because the design:

1) Is associated with less loosening
3) Increases particulate debris
2) Allows more versatility in matching proximal and distal femoral geometry
5) Leads to more osteolysis
4) Leads to less osteolysis

Modularity in noncemented femoral components is popular because it allows more versatility in matching proximal and distal femoral geometry. However, additional research is needed to determine if particulate debris leads to osteolysis and failure.Correct Answer: Allows more versatility in matching proximal and distal femoral geometry

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220. (1812) Q1-2213:

Patch porous-coated femoral implants failed because they:

1) Provided a poor distal fit
3) Caused stress fracture at the porous-coated site
2) Increased micromotion of the implant
5) Caused excessive polyethylene wear
4) Provided channels for egress of particulate debris

Patch porous-coated femoral implants failed because they provided channels for the particulate debris to move distally, resulting in diaphyseal osteolysis. A poor proximal fit permits the polyethylene particulate debris to erode around the femoral component.Correct Answer: Provided channels for egress of particulate debris

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221. (1813) Q1-2214:

Which of the following is the preferred thickness for hydroxyapatite coatings:

1) 5 Âµm
3) 50 Âµm
2) 20 Âµm
5) 400 Âµm
4) 200 Âµm

Thick hydroxyapatite coatings of 200 Âµm or more are at risk for fracture and delamination, and thin coatings of 20 Âµm or less may be resorbed too quickly. The best compromise appears to be 50 Âµm, which is thick enough so that resorption does not take place too quickly.Correct Answer: 50 Âµm

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222. (1814) Q1-2215:

Periprosthetic bone loss occurs by all of the following mechanisms except:

1) Stress shielding
3) Implant extraction
2) Osteolysis
5) Erosion by infection
4) Impaction grafting

Stress shielding, osteolysis, and implant extraction result in bone loss and must be minimized to maintain bone stock. Impaction grafting is a technique used to increase bone stock.Correct Answer: Impaction grafting

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223. (1815) Q1-2216:

Stress shielding occurs in the proximal femur secondary to:

1) Cemented femoral implants
3) Stiffer implants that allow more distal bone growth
2) Noncemented femoral implants
5) All of the above.
4) Modular designs

Stress shielding occurs secondary to cemented femoral implants, noncemented femoral implants, and stiffer, longer implants that allow more distal bone growth. Stress shielding is also related to the geometry of the implant and bone quality. Modular designs alone do not cause stress shielding.Correct Answer: All of the above.

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224. (1816) Q1-2217:

Thigh pain in noncemented implants is frequently a consequence of:

1) Stem loosening
3) Bony stabilization of implant
2) Fibrous stabilization of implant
5) Stem loosening and bony stabilization of implant
4) Stem loosening and fibrous stabilization

Thigh pain in noncemented implants is frequently a consequence of stem loosening and fibrous stabilization. Thigh pain has not been associated with bony stabilization of the implant because there is no stem loosening if there is adequate bony stabilization.Correct Answer: Stem loosening and fibrous stabilization

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225. (1817) Q1-2218:

All of the following strategies are used to reduce the micromotion between the flexible bone of the femur and a stiff femoral implant except:

1) Providing external porous coatings to the tip of the stem
3) Tapering the stem tip
2) Reducing contact between the tip of the stem and cortical bone
5) Expanding the stem tip so that it compresses on the cortex
4) Cementing the femoral component

Providing external porous coatings to the tip of the stem, reducing contact between the tip of the stem and cortical bone, and tapering the stem tip are strategies that have been used to reduce micromotion. Cementing the femoral component will also reduce micromotion.Correct Answer: Expanding the stem tip so that it compresses on the cortex

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226. (1818) Q1-2219:

All of the following methods are used to reduce the modulus of elasticity of the distal stem except:

1) Stems with slots
3) Enlarging the distal stem tip
2) Slimming and boring out the center of the distal stem
5) Diaphyseal cutouts
4) Hollow distal stems

Stems with slots, diaphyseal cutouts, and hollow distal stems have been used to reduce stem stiffness. Enlarging the distal stem tip increases the modulus of elasticity of the distal stem.Correct Answer: Enlarging the distal stem tip

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227. (1819) Q1-2220:

The major biomechanical function of the femoral component in total hip arthroplasty is to:

1) Optimize leg length
3) Accomodate the femoral head
2) Anchor the prosthetic femoral head to the femur
5) Replace poor bone stock
4) Equalize leg length

Anchoring the prosthetic femoral head to the femur and substituting for the femoral head and neck are the major biomechanical functions of the femoral component in total hip arthroplasty. One can decrease or increase leg lengths by changing the size of a femoral component, specifically the neck length.Correct Answer: Anchor the prosthetic femoral head to the femur

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228. (1820) Q1-2221:

Which of the following is the most common cause of osteonecrosis of the femoral head:

1) Corticosteroids
3) Nitrogen bubbles
2) Displaced transcervical fracture
5) Sickle cell disease
4) Coagulopathies

Displaced transcervical fractures of the cervical neck of the femur are the most common cause of osteonecrosis of the femoral head. Although corticosteroid use, nitrogen bubbles, coagulopathies, and sickle cell disease can also cause osteonecrosis, the highest incidence is seen with displaced transcervical fractures.Correct Answer: Displaced transcervical fracture

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229. (1821) Q1-2222:

In the United States, what percentage of primary total hip replacements are performed due to osteonecrosis:

1) 3%
3) 10%
2) 5%
5) 20%
4) 15%

In the United States, approximately 10% of primary total hip replacements are performed due to osteonecrosis. The majority of total hip replacements occur secondary to osteoarthritis.Correct Answer: 10%

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230. (1822) Q1-2223:

Osteonecrosis is bilateral in what percentage of patients between 25 and 45 years of age with a diagnosis of AVN of one hip:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

Adults between 25 and 45 years old are most frequently affected with osteonecrosis, and the condition is bilateral in more than 50% of patients. The condition is usually secondary to alcoholism, corticosteroid use, sickle cell disease, and coagulopathies, as opposed to transcervical neck fractures seen in the elderly.Correct Answer: 50%

---

231. (1823) Q1-2224:

All of the mechanisms listed below have been implicated in causing osteonecrosis except:

1) Intravascular coagulation
3) Embolization of fat
2) Hemodilation of blood
5) Sickle cells
4) Nitrogen bubbles

Factors causing intravascular coagulation or thrombosis, not hemodilation, are the most important mechanisms implicated in causing osteonecrosis.Correct Answer: Hemodilation of blood

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232. (1824) Q1-2225:

Which of the following is the most common factor implicated in the development of osteonecrosis:

1) Excessive alcohol intake
3) Nonsteroidal anti-inflammatory drugs (COX 1)
2) Gout medication
5) Nonsteroidal anti-inflammatory drugs (COX 2)
4) Ciprofloxin administration

Excessive alcohol intake and chronic steroid administration are the common factors implicated in the development of osteonecrosis. Although there have been case reports indicating nonsteroidal anti-inflammatory drugs, it is questionable if this was the cause.Correct Answer: Excessive alcohol intake

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233. (1825) Q1-2226:

What percentage of patients exposed to heavy alcohol consumption will develop osteonecrosis:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

Less than 5% of patients exposed to heavy alcohol consumption develop osteonecrosis.Correct Answer: 5%

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234. (1826) Q1-2227:

What percentage of patients exposed to high dosages of corticosteroids develop avascular necrosis:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

Five percent to 10% of patients who receive high doses of corticosteroids develop avascular necrosis. Why only a small percentage of patients develop avascular necrosis is poorly understood, and there may be some genetic predisposition.Correct Answer: 10%

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235. (1827) Q1-2228:

Subtle coagulation defects are found in what percentage of patients with osteonecrosis:

1) 20%
3) 40%
2) 30%
5) 70%
4) 50%

Seventy percent of patients with osteonecrosis have some subtle coagulation defect.Correct Answer: 70%

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236. (1828) Q1-2229:

The radiolucent crescent sign on radiographs of the hip:

1) Is present only in the stage II disease avascular necrosis
3) Is caused by collapse of the subchondral trabeculae
2) Occurs in the articular cartilage
5) Is present only after articular cartilage loss
4) Is more clearly seen on magnetic resonance imaging

The crescent sign is caused by subchondral trabeculae collapse before flattening of the articular surface. The success of core decompression is markedly diminished after this finding is seen on radiographs.Correct Answer: Is caused by collapse of the subchondral trabeculae

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237. (1829) Q1-2230:

The articular cartilage of the femoral head remains intact until after trabecular collapse because:

1) Nutrition comes from the metaphyseal bone
3) Nutrition comes from the epiphysis
2) Nutrition comes from the synovial fluid
5) Nutrition comes from the diaphysis by way of vessels in the metaphysis
4) Nutrition comes from the synovial membrane

Cartilage receives its nutrition through the synovial fluid. Only after collapse of the head is articular cartilage subjected to abnormal mechanical pressures that lead to degeneration.Correct Answer: Nutrition comes from the synovial fluid

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238. (1830) Q1-2231:

On radiograph, what stage of osteonecrosis is associated with a dense necrotic lesion with a sclerotic border but no crescent sign:

1) Stage I
3) Stage III
2) Stage II
5) Stage V
4) Stage IV

Stage II of osteonecrosis has good cartilage space without collapse, and a dense necrotic lesion with sclerotic border but does not have a crescent sign. Stage I is detected on magnetic resonance imaging, and stages III and IV are advanced forms of osteonecrosis.Correct Answer: Stage II

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239. (1831) Q1-2232:

The early stages of osteonecrosis are best detected by:

1) Anteroposterior and lateral radiographs
3) Magnetic resonance image (MRI)
2) Bone scans
5) Single photon computed tomography
4) Computed tomography

If present, radiographic changes are detected by MRI in more than 90% of cases. MRI remains the most sensitive test for osteonecrosis and becomes positive before changes are present on the roentgenogram.Correct Answer: Magnetic resonance image (MRI)

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240. (1832) Q1-2233:

What percentage of hips diagnosed clinically with osteonecrosis go on to femoral head collapse:

1) 30%
3) 50%
2) 40%
5) 80%
4) 70%

Approximately 70% of hips diagnosed clinically with osteonecrosis go on to femoral head collapse. The majority of hips progress to the severe form of the disease and will ultimately require total joint arthroplasty.Correct Answer: 70%

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241. (1833) Q1-2235:

The most promising results with electrical stimulation for treatment of osteonecrosis are with:

1) Direct current
3) Pulsing electromagnetic fields
2) Capacitive coupling
5) Concurrent bone grafting
4) Indirect current

The results of a multicenter study show promising results with pulsing electromagnetic fields. Pulsing electromagnetic fields were found effective as a symptomatic management in precollapsed lesion and as effective as core decompression.Correct Answer: Pulsing electromagnetic fields

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242. (1834) Q1-2236:

Core decompression for osteonecrosis of the femoral head does not act through which of the following mechanisms:

1) Decreasing the intraosseous pressure
3) Stimulating the repair process
2) Opening channels for vascular ingrowth
5) Increasing vascularity to the avascular area
4) Increasing structural integrity

Core decompression is affected by a number of mechanisms including decreasing the intraosseous pressure, opening channels for vascular ingrowth, and stimulating the repair process through increased vascularity. Core decompression does not increase structural integrity of the area.Correct Answer: Increasing structural integrity

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243. (1835) Q1-2237:

Urbaniak and associates reported a success rate of treating osteonecrosis before collapse:

1) 10%
3) 50%
2) 30%
5) 90%
4) 70%

Urbaniak and associates reported a success rate of 70% with mild collapse and 80% before collapse. Their results have not been duplicated as yet. The results of their study are much better than those reported with fibular graft.Correct Answer: 70%

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244. (1836) Q1-2238:

The incidence of deep infection complicating primary total hip arthroplasty is:

1) 0.25%
3) 1%
2) 0.5%
5) 3%
4) 2%

The incidence of deep infection in primary total hip replacement is 1%. After revision hip surgery, the percentage increases 3% to 4%. Repeated revisions are associated with increasing infection rates.Correct Answer: 1%

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245. (1837) Q1-2239:

The most common organism implicated in an infected total hip replacement is:

1) *Staphylococcus aureus*
3) *Staphylococcus epidermidis*
2) *Streptococcus*
5) *Salmonella typhi*
4) *Escherichia coli*

Staphylococcus epidermidis accounts for 50% to 75% of all arthroplasty infections. This is the most common organism cultured from the skin of preoperative patients.Correct Answer: *Staphylococcus epidermidis*

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246. (1838) Q1-2240:

Organisms survive on biosynthetic surfaces, such as total hips, because of:

1) Sulphate molecules on the surface
3) Polysaccharide biofilm on the surface
2) Their natural occurrence in the human body
5) Mucopolysaccharide present in the synovial fluid
4) They are protected by the sodium hyalurinate

Antibiotic resistance, the organismâs ability to form a glycocalyx or polysaccharide biofilm, and a slime layer enable the organism to survive on implants. This is one of the reasons why it is difficult to clear up an infection using only antibiotics.Correct Answer: Polysaccharide biofilm on the surface

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247. (1839) Q1-2241:

Preoperatively, what percentage of patients undergoing total hip replacement have methicillin-resistant *Staphylococcus aureus* (MRSE) organisms on their skin:

1) 10%
3) 35%
2) 25%
5) 65%
4) 40%

Preoperatively, 25% of skin swabs taken in 100 patients undergoing total hip replacement were MRSE resistant. This is probably a direct result of the overuse of antibiotics by practicing physicians.Correct Answer: 25%

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248. (1840) Q1-2242:

After analyzing 148,359 primary total hip arthroplasties, the Swedish Registry found the lowest risk of revision was:

1) Ventilated suits
3) Palacos-gentamicin cement
2) Laminar flow
5) Palacos cement
4) Sugeon dependent

The Swedish Registry found the lowest risk of revision was in patients who had palacos-gentamicin cement. No effect was found with ventilated suits or laminar flow.Correct Answer: Palacos-gentamicin cement

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249. (1841) Q1-2243:

The erythrocyte sedimentation rate (ESR) returns to normal how long after a total hip replacement:

1) 6 weeks
3) 6 months
2) 2 months
5) 1 year
4) 9 months

The ESR takes more than a year to return to normal after a total hip replacement.Correct Answer: 1 year

---

250. (1842) Q1-2244:

An erythrocyte sedimentation rate (ESR) of what level is considered a good cutoff for guiding an index of suspicion for infection:

1) 10 mm/hr
3) 30 mm/hr
2) 20 mm/hr
5) 60 mm/hr
4) 40 mm/hr

With an ESR of 30 mm/hr to 35 mm/hr, sensitivities have been reported from 0.60 to 0.96 and specificities from 0.65 to 1.00.Correct Answer: 30 mm/hr

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251. (1843) Q1-2245:

C-reactive protein (CRP) peaks 48 hours postoperatively and rapidly declines to normal in _____ weeks without persistent infection or inflammation.

1) 1 to 2
3) 4 to 6
2) 2 to 3
5) 8 to 10
4) 5 to 7

The CRP returns to normal in 2 to 3 weeks without persistent infection or inflammation. High levels beyond 2 to 3 weeks suggest persistent infection.Correct Answer: 2 to 3

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252. (1844) Q1-2246:

As the most direct and predictable preoperative diagnostic test for hip infection, the false-positive rate for hip aspiration is:

1) 0%
3) 15% to 25%
2) 0% to 15%
5) 40% to 50%
4) 25% to 40%

Hip aspiration has a false-positive rate of 0% to 15%. Many authors have warned against its routine use before revision surgery.Correct Answer: 0% to 15%

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253. (1845) Q1-2247:

What levels of polymorphonuclear leukocytes (PMN) per high-power field (HPF) are inconsistent with infection when performing intraoperative frozen sections of total joint replacement:

1) No value as predictor
3) <8 PMN/HPF
2) <5 PMN/HPF
5) <15 PMN/HPF
4) <10 PMN/HPF

When using <5 PMN/HPF as a cut off for an infected total joint, the sensitivity was 100% and specificity was 96%.Correct Answer: <5 PMN/HPF

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254. (1846) Q1-2248:

False-positive results with intraoperative culture as confirmation of periprosthetic joint infection are reported to be:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

The false-positives results are reported to be between 6% and 13% and are probably related to break in sterility while obtaining, transferring, and plating the specimen.Correct Answer: 10%

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255. (1847) Q1-2249:

It is recommended to use which of the following drugs in patients who are too sick for a surgical procedure and antibiotic suppression:

1) Amikacin
3) Imipenem
2) Ofloxacin
5) Rifampin
4) Vancomycin

Amikacin, ofloxacin, imipenem, and vancomycin are only effective against growing bacteria. Rifampin, which affects messenger RNA synthesis, is the only drug capable of inducing strong enough pharmacodynamic effects to inhibit both growing and nongrowing *Staphylococcus epidermidis*.Correct Answer: Rifampin

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256. (1848) Q1-2250:

The highest dislocation rate for total hip arthroplasty is associated with which of the following surgical approaches:

1) Anterior approach
3) Transtrochanteric approach
2) Posterior approach
5) All of the approaches have the same incidence of dislocation.
4) Hardinge approach

The anterior approach has a dislocation rate of 3.5%, posterior approach 4.6%, and transtrochanteric approach 7.6%.Correct Answer: Transtrochanteric approach

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257. (1849) Q1-2251:

The prevalence of dislocation following a primary bipolar hemiarthroplasty is:

1) The same as primary total hip arthroplasty
3) Lower than primary total hip arthroplasty
2) Higher than primary total hip arthroplasty
5) Not dependent on the surgical approach
4) Higher than semipolar hemiarthroplasty

The prevalence of dislocation following a primary bipolar hemiarthroplasty is 1.5% compared to 3.5% or higher (depending on the surgical approach) for a total hip arthroplasty.Correct Answer: Lower than primary total hip arthroplasty

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258. (1850) Q1-2252:

Which of the following patient-related factors is a risk factor for dislocation after total hip arthroplasty:

1) Gender
3) Acute femoral neck fracture
2) Height
5) Previous knee surgery
4) Weight

In addition to an acute femoral neck fracture, other patient-related factors associated with dislocation after total hip arthroplasty include patients older than 80 years and previous hip surgery.Correct Answer: Acute femoral neck fracture

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259. (1851) Q1-2253:

Which of the following factors is associated with the highest incidence of total hip dislocation after surgery:

1) Acetabular component malposition in a vertical position
3) Acetabular component in a retroverted position
2) Femoral component malposition in a varus position
5) Femoral component malposition in a valgus position
4) Muscular imbalance

A computed tomography study of dislocated total hip arthroplasties (THAs) compared to uncomplicated THAs showed no difference between the alignment of the components in either group. Muscular imbalance rather than malposition of components was the major factor in determining dislocation.Correct Answer: Muscular imbalance

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260. (1852) Q1-2254:

Which of the following is associated with an increased risk of dislocation after a total hip arthroplasty:

1) Elevated rim liner
3) 32-mm femoral head
2) Skirt (reinforcement of the bone at the neck)
5) Ceramic-on-ceramic hip arthroplasty
4) Metal-on-metal hip arthroplasty

There is an increased risk of dislocation with a skirt. The elevated rim liner decreases the risk of a dislocation, and a 32-mm femoral head may or may not have a decreased rate of dislocation.Correct Answer: Skirt (reinforcement of the bone at the neck)

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261. (1853) Q1-2255:

Which of the following factors is not associated with dislocation of a total hip arthroplasty:

1) Infection
3) Profound weight loss
2) Trauma
5) Gender
4) Chronic illness

Infection, trauma, and profound weight loss are associated with an increased risk of dislocation. Infection with septic fluid accumulation stretches the capsule. Trauma from a fall is a direct cause of dislocation, and profound weight loss with its accompanying loss of muscle mass (as a result of cancer or chronic illness).Correct Answer: Gender

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262. (1854) Q1-2256:

What percentage of patients with an initial dislocation of the hip will have recurrent dislocation:

1) 5%
3) 20%
2) 10%
5) 50%
4) 33%

One-third of patients with a dislocated total hip arthroplasty will have recurrent dislocations. This number is potentially minimized by having patients wear an abduction splint for 6 to 12 weeks after the initial dislocation.Correct Answer: 33%

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263. (1855) Q1-2257:

The highest incidence of deep infection in total hip arthroplasty is associated with what patient group:

1) Patients with rheumatoid arthritis
3) Patients with diabetes mellitus
2) Patiens with psoriatic arthritis
5) Women
4) Patients with avascular necrosis

The highest incidence of deep infection is in patients with diabetes mellitus (5.6%) compared to patients with rheumatoid arthritis (1.2%) and patients with psoriatic arthritis (5.5%). Any immune-compromised patient is at a higher risk for infection following total hip arthroplasty.Correct Answer: Patients with diabetes mellitus

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264. (1856) Q1-2258:

The most common complication after total hip arthroplasty is:

1) Infection
3) Deep vein thrombosis
2) Dislocation
5) Urinary tract infection
4) Pulmonary embolism

The incidence of deep vein thrombosis is as high as 70% and as low as 8%.Correct Answer: Deep vein thrombosis

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265. (1857) Q1-2259:

The incidence of deep vein thrombosis is reported to be highest on postoperative day:

1) 1
3) 3
2) 2
5) 5
4) 4

The incidence of deep vein thrombosis is reported to be highest on postoperative day 4.Correct Answer: 4

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266. (1858) Q1-2260:

Which of the following is the gold standard to rule out a pulmonary embolism:

1) Radiograph
3) Electrocardiogram
2) Ventilation perfusion scan
5) Pulmonary angiogram
4) Ultrasonography

The gold standard for detecting pulmonary embolus is the pulmonary angiogram, although a combination chest radiograph, ventilation perfusion scan, and electrocardiogram is usually performed.Correct Answer: Pulmonary angiogram

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267. (1859) Q1-2261:

What incidence of bleeding complications is attributed to the treatment of postoperative thomboembolic disease with heparin when it is administered intravenously in the first 6 days after total hip arthroplasty:

1) 5%
3) 25%
2) 15%
5) 60%
4) 45%

The risk of bleeding complications from therapeutic anticoagulation is high in the immediate postoperative period with a 45% incidence.Correct Answer: 45%

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268. (1860) Q1-2262:

All of the following conditions are associated with an increased risk of heterotopic ossification after total hip arthroplasty except:

1) Ankylosing spondylitis
3) Posttraumatic arthritis
2) Forestier disease
5) Rheumatoid arthritis
4) Men with bilateral osteophytic osteoarthritis

Ankylosing spondylitis, Forestier disease, posttraumatic arthritis, and men with bilateral osteophytic osteoarthritis are associated with an increased risk of heterotopic ossification following total hip arthroplasty.Correct Answer: Rheumatoid arthritis

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269. (1861) Q1-2263:

What is the lowest dose of radiation that is effective in preventing heterotopic bone formation after total hip arthroplasty:

1) 1000 Rads
3) 3000 Rads
2) 2000 Rads
5) 5000 Rads
4) 4000 Rads

A protocol of 1000 Rads is as effective as 2000 Rads.Correct Answer: 1000 Rads

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270. (1862) Q1-2264:

The incidence of trochanteric nonunion after greater trochanteric osteotomy in primary total hip arthroplasty is:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

There is a 5% incidence of trochanteric nonunion after greater trochanteric osteotomy in primary total hip arthroplasty.Correct Answer: 5%

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271. (1863) Q1-2265:

The main purpose of a trochanteric osteotomy is to:

1) Decrease the operative time
3) Lateralize the adduction mechanism
2) Enhance exposure
5) Decrease the blood loss
4) Prevent dislocation

Enhancing exposure and lateralizing the abductor mechanism are the main reasons for performing an osteotomy. The osteotomy must be balanced against the increased blood loss, operative time, and slower rehabilitation.Correct Answer: Enhance exposure

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272. (1864) Q1-2266:

Breakage of stems in total hip arthroplasty is related to all of the following except:

1) Excessive head-stem offset
3) Size of stem
2) Modularity
5) Inadequate cross-sectional area
4) Material strength

All of the factors, except modularity, contribute to early stem breakage in the first generation of total hips.Correct Answer: Modularity

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273. (1865) Q1-2267:

In early first-generation total hip implant designs, fatigue fractures occurred in which of the following areas of the femoral stem:

1) Posterolateral
3) Anterolateral
2) Posteromedia
5) Anterior
4) Anteromedial

In early first-generation total hip implant designs, fatigue fractures occurred anterolaterally because that was the area of greatest tension. Fatigue fractures are less common in compression.Correct Answer: Anterolateral

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274. (1866) Q1-2268:

Total hip arthroplasty for a congenital dislocated hip has a nerve injury incidence of:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

The incidence of nerve injury following congenital dislocated hip is 5.2% compared to 0.6% to 3.7% for routine total hip arthroplasty.Correct Answer: 5%

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275. (1867) Q1-2269:

Which of the following arteries is at the greatest risk for vascular injury during a total hip arthroplasty for protrusio acetabuli:

1) Femoral artery
3) Common iliac artery
2) Obturator artery
5) Popliteal artery
4) Peroneal artery

The common and superficial iliac arteries are most at risk in patients with protrusio acetabuli. The obturator is not at risk when removing the transverse ligament from the inferior margin of the cup.Correct Answer: Common iliac artery

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276. (1868) Q1-2270:

Debonding (separation of the femoral stem from the surrounding cement mantle) is caused by:

1) Tension forces from muscle contraction
3) Torsional forces in retroversion
2) Strain at the cement-metal interface
5) Compression forces from muscle contraction
4) Rotational forces in anteversion

When arising from a chair or climbing the stairs, the stem shifts to a more retroverted position within the cement mantle secondary to the peak torsional forces in retroversion.Correct Answer: Torsional forces in retroversion

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277. (1869) Q1-2271:

Which of the following terms is defined as a fundamental wear mechanism in joint replacement known as bonding of the surfaces when they are pressed together under load:

1) Abrasion
3) Adhesion
2) Fatigue
5) Compression
4) Cohesion

Abrasion, fatigue, and adhesion are fundamental wear mechanisms. Adhesion is the binding of the surfaces when they are pressed together under load.Correct Answer: Adhesion

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278. (1870) Q1-2274:

The volumetric wear of polyethylene is greatest with what size head:

1) 32 mm
3) 26 mm
2) 28 mm
5) 20 mm
4) 22 mm

The volumetric wear of polyethylene is proportional to the size of the femoral head and larger femoral heads have a longer sliding distance that results in greater wear.Correct Answer: 32 mm

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279. (1871) Q1-2275:

Preparing and sterilizing polyethylene with gamma radiation:

1) Increases the molecular weight of the material
3) Increases recombination of the polyethylene particles
2) Decreases free radicals that can react with carbon dioxide
5) Increases free radicals that react with carbon dioxide
4) Stabilizes free radicals that react with carbon dioxide

Gamma radiation prevents recombination, decreases the molecular weight of the material, and increases free radicals that react with carbon dioxide to form ketone esters and carbolic acid groups.Correct Answer: Increases free radicals that react with carbon dioxide

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280. (1872) Q1-2276:

In osteolysis, small wear debris is broken down and ingested by:

1) Polymorphonuclear neutrophils
3) Macrophages
2) Foreign body giant cells
5) Osteoblasts
4) Histiocytes

Small wear debris is phagocytosed by macrophages. Large wear debris is surrounded by foreign body giant cells.Correct Answer: Macrophages

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281. (1873) Q1-2278:

Based on the volume of polyethyelene wear in some total hip arthoplasties and the average portal size, the number of particles generated with each gait cycle is:

1) 500
3) 100,000
2) 50,000
5) 500,000
4) 300,000

The average number of particles generated with each gait cycle is approximately 500,000.Correct Answer: 500,000

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282. (1982) Q1-2396:

All of the following are consequences of using too large of a femoral component in total knee replacement except:

1) Overstuffing the joint
3) Decreasing range of motion
2) Limitation of quadriceps excursion
5) Increasing range of motion
4) A cause of postoperative knee pain

Too large of a femoral component in total knee replacement may result in overstuffing the joint, limiting quadriceps excursion, and decreasing range of motion.Correct Answer: Increasing range of motion

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283. (1983) Q1-2397:

It is acceptable for the joint line to be elevated how many millimeters during total knee replacement surgery:

1) 0 mm
3) 2 mm
2) 1 mm
5) 4 mm
4) 3 mm

It is acceptable for the joint line to be raised approximately 2 mm during total knee replacement, but any higher elevation may create mid-flexion laxity.Correct Answer: 2 mm

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284. (1984) Q1-2399:

When performing a total knee replacement and you are in between sizes, it is best to:

1) Downsize the femoral component and recut the femur in 3Â° of flexion
3) Upsize the prosthesis
2) Downsize the femoral component and recut the femur in 6Â° of flexion
5) Upsize the prosthesis and recut the femur in 6Â° of extension.
4) Downsize the femoral component and minimalize notching the anterior cortex

An option for downsizing without notching is to recut the distal femur in slight flexion, applying a modified distal cutting block that will add several degrees of flexion to the distal cut. Recutting the distal femur in slight (3Â°) flexion has the following rationale: the normal trochlear flange of most components already diverges approximately 3Â°. By adding another 3Â° of flexion one can use a smaller component because the trochlear flange will now diverge 6Â°, avoiding a notch in the anterior cortex. The advantage is that the posterior condylar resection remains anatomic and the level of the joint line is preserved.Correct Answer: Downsize the femoral component and recut the femur in 3Â° of flexion

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285. (1985) Q1-2400:

The primary features of a posterior stabilized total knee replacement include all of the following except:

1) Femoral cam
3) Conforming articular geometry
2) Polyethylene post on the tibial component
5) Constrained hinge
4) Use of cement

The primary features of posterior stabilized total knee devices include femoral cam, polyethylene post on the tibial component, conforming articular geometry, and use of cement. These characteristics have produced total knee prostheses with unsurpassed clinical survivorship and patient function.Correct Answer: Constrained hinge

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286. (1986) Q1-2401:

The clinical survivorship of posterior stabilized prostheses at 10 years is:

1) 80%
3) 90%
2) 85%
5) 98%
4) 95%

The clinical survivorship of posterior stabilized prostheses is spectacular by any standards with a success rate of approximately 95% of prostheses that were free from revision due to aseptic loosening at 10 to 15 years.Correct Answer: 95%

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287. (1987) Q1-2402:

If the posterior cruciate ligament (PCL) is too loose in flexion in a cruciate-retaining prosthesis, the result is:

1) Flexion gap
3) Increased posterior sliding of the femorotibial contact point
2) Extension gap
5) Hyperextension deformity
4) Restricted flexion

If the PCL is too loose, anterior translation of the femorotibial contact point will occur, whereas if the PCL is too tight, flexion will be restricted.Correct Answer: Flexion gap

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288. (1988) Q1-2403:

If the posterior cruciate ligament (PCL) is too tight in flexion in a cruciate-retaining total knee replacement, the result is:

1) Flexion gap
3) Restricted flexion
2) Restricted extension
5) Increased flexion
4) Hyperextension deformity

If the PCL is too loose, anterior translation of the femorotibial contact point will occur, whereas if the PCL is too tight, flexion will be restricted.Correct Answer: Restricted flexion

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289. (1989) Q1-2404:

If a flexion gap is observed while performing a trial reduction of components before cementing a total knee replacement, a surgeon should consider:

1) Using a smaller tibial insert
3) Resecting more femur in extension
2) Resecting more tibial bone
5) Increasing the size of the femoral component
4) Using a deep dish insert

Hofmann and colleagues reviewed their use of ultracongruent polyethylene over 7 years in 100 patients who underwent PCL-substituting total knee arthroplasties. Fifty-three cases were primary and 47 were revisions. There were no cases of anteroposterior (AP) instability in either revision or primary cases when a deep-dish polyethylene was inserted. The incidence of AP instability using standard inserts was 2% to 3%.Correct Answer: Using a deep dish insert

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290. (1990) Q1-2405:

Patellar clunk syndrome is caused by:

1) Too large a patellar component
3) Fibrous tissue build-up occurring in a large intercondylar notch of the prosthesis
2) Too small a patellar component
5) Dislocation of the quadriceps mechanism over a malrotated femoral component
4) Too large a femoral component

Patellar clunk occurs from a large intercondylar notch of the prosthesis, which causes fibrous tissue build-up proximally and can result in 1% to 2% of patients requiring arthroscopic debridement.Correct Answer: Fibrous tissue build-up occurring in a large intercondylar notch of the prosthesis

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291. (1991) Q1-2406:

All of the following is a reported complication of posts in posterior cruciate-retaining prostheses except:

1) Patellar fracture
3) Patellar clunk syndrome
2) Knee dislocation
5) Flexion instability
4) Post fracture

Complications reported with the use of posts include patellar fractures, knee dislocations, and patellar clunk syndrome.Correct Answer: Flexion instability

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292. (1992) Q1-2407:

In a posterior cruciate-retaining prosthesis, most stress at the posterior cruciate ligament occurs in:

1) Extension
3) 30Â° flexion
2) 15Â° flexion
5) 90Â° flexion
4) 45Â° flexion

A consequence of the kinematics of a crossed four-bar link is the phenomenon of rollback, that is, the progressive movement of the femoral condyle posteriorly relative to the tibia with increasing flexion.Correct Answer: 90Â° flexion

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293. (1993) Q1-2408:

Cruciate ligament deficiency can lead to abnormalities during all of the following except:

1) Stair climbing
3) Walking on uneven ground
2) Rising from a chair
5) Full extension
4) Stepping up a curb

Cruciate ligament deficiency can lead to abnormalities during stair climbing, rising from a chair, and walking on uneven ground.Correct Answer: Full extension

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294. (1994) Q1-2410:

C-reactive protein should return to normal how many weeks after a total knee replacement surgery:

1) 1 week
3) 3 weeks
2) 2 weeks
5) 12 weeks
4) 6 weeks

C-reactive protein should return to normal within 3 weeks of surgery.Correct Answer: 3 weeks

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295. (1995) Q1-2411:

One can best avoid bone stiffness after total knee replacement (TKR) by:

1) Careful attention to proper sizing of the components
3) Maintenance of physiologic soft tissue tension in complete extension and at 90Â° of flexion
2) Restoration of the mechanical axis and anatomic joint line
5) None of the above
4) All of the above

Avoiding stiffness after TKR is easier than managing the stiff total knee. Careful attention to proper sizing of components, restoration of the mechanical axis and anatomic joint line, and maintenance of physiologic soft-tissue tension in complete extension and at 90Â° of flexion will minimize the risk of stiffness following TKR.Correct Answer: All of the above

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296. (1996) Q1-2412:

Flexion contractures after total knee replacement are best treated by:

1) Manipulation
3) Dynamic extensor splint
2) Physical therapy
5) All of the above
4) Physical therapy, and dynamic extensor splint

Flexion contractures are treated with physical therapy and the use of a dynamic extension splint at night.Correct Answer: Physical therapy, and dynamic extensor splint

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297. (1997) Q1-2413:

The incidence of periprosthetic fracture about total knee replacement is:

1) 0.2%
3) 5%
2) 3%
5) 9%
4) 7%

Periprosthetic fractures about total knee arthoplasty (TKA) are relatively rare (0.5% to 3%).Correct Answer: 3%

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298. (1998) Q1-2414:

Wear debris particles in cross-linked polyethylenes are:

1) Less than 0.1 Âµm
3) 1 Âµm to 2 Âµm
2) 0.1 Âµm to 0.5 Âµm
5) Larger than 3 Âµm
4) 2 Âµm to 3 Âµm

Studies have shown that cross-linked polyethylenes are stiffer and weaker than conventional polyethylene, and wear debris particles generated usually are less than 1 Âµm (0.1 Âµm to 0.5 Âµm), which is the most biologically active particle size.Correct Answer: 0.1 Âµm to 0.5 Âµm

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299. (1999) Q1-2415:

Which of the following is the most common cause for revising a total hip arthroplasty (THA) when polyethylene is used:

1) Infection
3) Debris-associated osteolysis
2) Thigh pain
5) Chronic dislocation
4) Wear

Debris-associated osteolysis is the most common cause for revision THA when polyethylene is used. Chronic dislocation, thigh pain, wear, and infection are less common causes for revision.Correct Answer: Debris-associated osteolysis

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300. (2000) Q1-2416:

Which of the following bearing surfaces has the lowest rate of wear in total hip arthroplasty:

1) Polyethylene-metal bearings
3) Ceramic-metal bearings
2) Metal-metal bearings
5) Alumina ceramic-ceramic bearings
4) Ceramic-polyethylene bearings

According to retrieval studies of Clarke and colleagues, alumina ceramic-ceramic bearings have the lowest rate of wear of any bearing surface.Correct Answer: Alumina ceramic-ceramic bearings

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301. (2001) Q1-2417:

Staphylococcus epidermidis adheres:

1) More strongly to polyethylene
3) Similarly to both polyethylene and alumina ceramic
2) More strongly to alumina ceramic
5) More strongly to polymethylmethacrylate
4) This has not been studied in a laboratory setting.

Staphylococcus epidermidis adheres 2.5 times more strongly to high density polyethylene than alumina ceramic.Correct Answer: More strongly to polyethylene

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302. (2002) Q1-2418:

The wear rate of ceramic-ceramic bearings in total hip arthroplasty is:

1) 0.05 to 0.06 mm/year
3) 0.03 to 0.02 mm/year
2) 0.04 to 0.05 mm/year
5) Too small to measure
4) 0.01 to 0.02 mm/year

The wear rate of ceramic-ceramic bearing surfaces in a 10-year follow-up was observed to be 0.01 mm/year.Correct Answer: 0.01 to 0.02 mm/year

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303. (2003) Q1-2419:

Which of the following observations concerning metal-metal prostheses is not true:

1) Low incidence of osteolysis
3) There is a theoretical concern of cancer
2) There is concern about increased metal ions in the body
5) High incidence of osteolysis
4) Hypersensitivity

The controversies with metal-metal total hip replacement relate to increased metal ions. In Europe, Hans Willert reported a 0.5% prevalence of hypersensitivity to metal-metal (personal communication, January 2001).

One advantage of metal-on-metal total hip replacement is a low incidence of osteolysis. Osteolysis in the cemented cup and the modular cup series has been better than that observed with standard polyethylene acetabular components.

There also is a theoretical concern of cancer. The 20-year studies from Scandinavia (particularly Finland) have not found any positive correlation to cancer.Correct Answer: High incidence of osteolysis

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304. (2004) Q1-2420:

The best predictor for the necessity of blood transfusion in total knee replacement is:

1) Preoperative hemoglobin
3) Use of a hemovac
2) Operative time
5) Surgical approach
4) Rheumatoid arthritis

The biggest predictor for transfusion is the preoperative hemoglobin. There is a 69% chance of an allogenic transfusion if the hemoglobin is less than 13 g/dL and only a 13% chance if more than 15 g/dL.Correct Answer: Preoperative hemoglobin

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305. (2005) Q1-2421:

A patient undergoing a total knee replacement with a preoperative hemoglobin >15 g/dL has what chance of requiring a transfusion:

1) 5%
3) 20%
2) 10%
5) 40%
4) 30%

There is a 69% chance of an allogenic transfusion if the hemoglobin is less than 13 g/dL and only a 13% chance if more than 15 g/dL. A surgeon must weigh the risks when lowering the preoperative hemoglobin below this level with autologous donation 1 or 2 weeks before surgery.Correct Answer: 10%

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306. (2006) Q1-2422:

The most effective method of reducing deep infection in total joint replacement is:

1) Antibiotic bone cement
3) Systemic antibiotics
2) Antibiotic bone cement plus systemic antibiotics
5) Adequate skin preparation
4) No antibiotics

The use of antibiotic bone cement plus systemic antibiotics is the most effective strategy in reducing deep infection. This is followed by the use of systemic antibiotics alone, antibiotic bone cement alone, and no antibiotics.Correct Answer: Antibiotic bone cement plus systemic antibiotics

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307. (2007) Q1-2423:

Which of the following bone cements is associated with the lowest risk ratio for revision hip surgery:

1) Sulfix
3) CMW
2) Simplex
5) Palacos gentamicin
4) Palacos

Malchau and colleagues also performed Poisson modeling, assessing the risk of deep infection in revision surgery using different types of bone cement. Using Sulfix bone cement (Sulzer, Winterhur, Switzerland) as the numerator, the investigators assessed Simplex (Stryker Howmedica Osteonics, Allentown, NJ), CMW (Johnson & Johnson DePuy, Warsaw, Ind), Palacos (Merck/Biomet, Warsaw, Ind), and Palacos gentamicin (Merck/Biomet) bone cements. They developed a risk ratio for revision using any of these bone cements. Palacos gentamicin bone cement was associated with the lowest risk ratio for revision.Correct Answer: Palacos gentamicin

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308. (2316) Q1-2769:

Early catastrophic failure of the precoat stem was due to:

1) A thin cement mantle
3) Excessive residual bone
2) Use of low viscosity cement
5) Proximal debonding associated with laser etching of the identifying numbers and letters on the stem
4) Proximal debonding

The catastrophic failure of the precoat stem was due to proximal debonding associated with laser etching of the identifying numbers and letters on the stem of the prosthesis. Virtually all reported stem failures occurred in left hips because the laser etching caused a local stress concentration effect on the higher stress anterior surface.Correct Answer: Proximal debonding associated with laser etching of the identifying numbers and letters on the stem

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309. (2322) Q1-2776:

Mallet injuries with greater than ___ percent of the articular surface involved and palmar subluxation as a result will most likely require surgical intervention:

1) 30
3) 10
2) 70
5) 90
4) 50

Type IVC injuries include distal phalanx base fractures involving more than 50% of the articular surface. Most surgeons feel that accurate reduction is mandatory to prevent joint deformity, secondary arthritis, and stiffness.Correct Answer: 50

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310. (2432) Q1-2893:

Slide 1

A 70-year-old man has difficulty ambulating following a knee replacement. The lateral radiograph of the knee is shown (Slide). The most likely cause of the disability is:

1) Lateral patellar instability
3) Quadriceps tendon rupture
2) Patellar tendon rupture
5) Axial instability
4) Flexion instability

Patients may present with severe knee pain after a mild traumatic event. Patients may have the inability to extend the knee or walk. Laxity in flexion (flexion instability) can result in dislocation of the femorotibial articulation. The cam of the femoral component rides up and over the top of the post of the tibial polyethylene insert. The dislocation is usually the result of a traumatic episode.

Flexion instability occurs in about 1% to 2% of knee replacements when the knee is not properly balanced following a replacement. The extension and flexion gap must be equal. When balancing a knee, especially one that is tight in extension, the surgeon may choose to place a smaller tibial polyethylene component to achieve full extension with resulting instability of the knee in flexion because the knee flexion gap is larger than the polyethylene insert.

Treatment of flexion instability in posterior stabilized knee replacements can be nonoperative with casting or bracing initially. Two-thirds of patients can be managed successfully nonoperatively. If symptoms persist, revision to a larger polyethylene component can be very effective. If the knee remains unstable, revision to a more constrained prosthesis may be necessary.Correct Answer: Flexion instability

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311. (2433) Q1-2894:

While performing posterior cruciate sacrificing knee replacement surgery, the surgeon notes a 15Â° flexion contracture during trial reduction after the bone cuts and soft tissue balancing. The best option is:

1) Placement of a smaller polyethylene insert
3) Resection of additional bone from the distal femur
2) Resection of additional bone from the proximal tibia
5) Accepting the contracture and applying an extension cast postoperatively
4) Resection of additional bone from the proximal tibia and distal femur

This is a common problem. Selection of a smaller polyethylene spacer results in a correction of the flexion contracture but also results in flexion instability as the flexion gap will be larger than the extension gap. First, surgeons should remove any posterior osteophytes from the distal femur. Second, the posterior capsule should be incised. If both of these maneuvers fail to correct the contracture, the surgeon should remove additional bone from the distal femur. The joint line may be raised up to 8 mm when performing posterior stabilized arthroplasties without compromising the result.Correct Answer: Resection of additional bone from the distal femur

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312. (2434) Q1-2895:

When performing total knee replacement surgery, the following statement is true:

1) The distal femoral cut only effects the extension gap.
3) The proximal tibia cut only effects the flexion gap.
2) The proximal tibia cut only effects the extension gap.
5) The posterior femoral condyle cut effects the flexion and extension gaps.
4) The distal femoral cut only effects the flexion gap.

These are important concepts when balancing the knee following total knee replacement.

- The distal femoral cut only effects the extension gap.
- The proximal tibia cut effects the flexion and extension gaps.
- The posterior femoral condyle cut effects the flexion only.

Attention to these principles is very important to prevent both contractures and flexion instability.

Correct Answer: The distal femoral cut only effects the extension gap.

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313. (2435) Q1-2896:

While performing revision total knee arthroplasty, the surgeon notices a flexion gap that is larger than the extension gap. The following statement is most likely true:

1) The femoral component is probably too large.
3) There is inadequate distal femoral augmentation.
2) There is posterior translation of the femoral component.
5) There is excessive thickness of the distal femoral augmentation blocks.
4) There is excessive thickness of the patellar component.

Flexion instability is common following revision total knee replacement. The following principles are important:

- Undersizing the femoral component is common. This occurs secondary to the posterior femoral condyle bone loss.
- Anterior translation of the femoral component increases the flexion gap. The use of posterior femoral condyle augments or an offset stem can solve this problem.
- Distal femoral augments that are too thick will narrow the extension gap. One should set the joint line approximately 25 mm to 30 mm below the epicondylar axis.

Excessive size of the patellar component will restrict knee flexion, however, it will not change the flexion and extension gaps.

Correct Answer: There is excessive thickness of the distal femoral augmentation blocks.

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314. (2436) Q1-2897:

The stem associated with the highest incidence of osteolysis is the:

1) Proximal coated femoral stem
3) Fully coated femoral stem
2) Distal coated femoral stem
5) Cemented femoral stem
4) Patch-porous coated femoral stem

The noncircumferentially coated titanium alloy patch-porous coated straight Harris-Galante stem was associated with significant osteolysis, thigh pain, subsidence, and endosteal erosion. The patched porous coating is believed to allow ingress of joint fluid and wear debris into the endosteal canal, increasing the effective joint space.Correct Answer: Patch-porous coated femoral stem

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315. (2437) Q1-2898:

During controlled perforation for removal of stem and prosthesis, when making 9-mm holes in the femoral diaphysis:

1) The size of the hole should be 20% of the diameter of the shaft
3) The size of the hole should be 60% of the diameter of the shaft
2) The size of the hole must not exceed 30% of the diameter of the shaft
5) The holes must be in the posterolateral surface of the femur
4) Two holes must be one hole diameter apart

The size of the hole must not exceed 30% of the diameter of the shaft. Holes should not be placed any closer than two hole diameters apart, and they should be located in the anterolateral surface of the femur to decrease the stress riser.Correct Answer: The size of the hole must not exceed 30% of the diameter of the shaft

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316. (2438) Q1-2899:

The gold standard for the diagnosis of avascular necrosis of the femoral head is:

1) Bone scan
3) Magnetic resonance image
2) Routine roentgenogram
5) Elevated sedimentation rate
4) Segmented bone collapse

The gold standard for the diagnosis of avascular necrosis is magnetic resonance imaging. Changes can be seen earliest with this technique before there are changes on routine roentgenogram and even before a patient is symptomatic.Correct Answer: Magnetic resonance image

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317. (2439) Q1-2900:

The low incidence of infection in ceramic-ceramic total hip replacement is:

1) True only in early infection
3) Has not been reported in the literature and is only anecdotal
2) True only in late infection
5) True because bacteria adhere more strongly to polyethylene
4) True because bacteria adhere more strongly to ceramic

There is a lower incidence of infection reported in ceramic-ceramic total hip replacements by the Swedish Hip Registry. This may be related to the fact that bacteria typically adhere more strongly to polyethylene than cement, suggesting that both early and late infection may be lower for alumina than polyethylene total hip replacement.Correct Answer: True because bacteria adhere more strongly to polyethylene

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318. (2440) Q1-2901:

The first step in the development of hip osteoarthritis is:

1) Abnormal glycosaminoglycans
3) Abnormal weight gain
2) Formation of ganglions
5) Abnormal mechanical stress
4) Fatiguing of labrum under normal stress

The first step toward osteoarthritis of the dysplastic hip is fatiguing of the labrum under normal stress. Klaue et al described the different pathomorphologies from a torn labrum to ganglion formation, which has been attributed to acetabular rim syndrome.Correct Answer: Fatiguing of labrum under normal stress

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319. (2462) Q1-2927:

The common iliac artery gives rise to all of the following vessels except:

1) The external iliac artery
3) The superior gluteal artery
2) The internal iliac artery
5) The internal hypogastric artery
4) The common femoral artery

The common iliac artery divides at the L5-S1 vertebral disk. The anterior division, the external iliac artery, continues distally to become the common femoral artery, whereas the posterior division becomes the internal iliac artery. The internal iliac artery branches again into a posterior division, which gives rise to the superior gluteal artery, and an anterior division, which gives off the obturator artery before dividing into the inferior gluteal artery and internal pudendal artery.Correct Answer: The internal hypogastric artery

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320. (2463) Q1-2928:

The structure at highest risk for injury in total hip arthroplasty (THA) is the:

1) Femoral artery
3) External iliac artery
2) Femoral vein
5) Obturator artery
4) Inferior gluteal artery

The external iliac artery and vein are immobile and lie close to the pelvis, and thus are at high risk for injury in THA. The external iliac vein lies within 7 mm of the anterior column of the pelvis at the anterior inferior iliac spine and within 4 mm at the acetabula dome. The external iliac artery is at less risk due to its thicker intima and increased distance from the bone. The external iliac artery lies within 10 mm of the bone at the anterior inferior iliac spine and within 7 mm at the acetabular dome. The common femoral artery lies anterior and medial to the hip capsule. Only the iliopsoas lies between the vessel and capsule at this point. The femoral vein lies medial to the artery and is not likely to be injured. The obturator vessels are also at risk, lying fixed within 1 mm of the bony surface at the quadrilateral surface, with their only protection being the interposition of the obturator internus muscle.Correct Answer: External iliac artery

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321. (2464) Q1-2929:

The nerve most commonly injured during total hip arthroplasty (THA) is the:

1) Superior gluteal nerve
3) Femoral nerve
2) Obturator nerve
5) Peroneal component of sciatic nerve
4) Inferior gluteal nerve

The primary nerves of the region are the sciatic, femoral, inferior and superior gluteal, and obturator. The most common nerve injury during THA is to the peroneal division of the sciatic nerve, followed by superior gluteal, obturator, and femoral nerves. Injury to these structures can lead to loss of function and poor outcomes.Correct Answer: Peroneal component of sciatic nerve

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322. (2465) Q1-2930:

Which two quadrants of the acetabulum are most at risk for injury by screws during fixation of total hip arthroplasty (THA):

1) Anterior-superior and posterior-inferior
3) Anterior-superior and posterior-superior
2) Posterior-superior and posterior inferior
5) Anterior-superior and anterior-inferior
4) Anterior-inferior and posterior-superior

The acetabular quadrant system described by Wasielewski and colleagues is useful for determining the location of planned acetabular screw fixation in THA to avoid neurovascular complications. The quadrants are formed by drawing a line from the anterior-superior iliac spine through the center of the acetabulum and bisecting that line at the center of the acetabulum to form four equal quadrants. The line from the anterior-superior iliac spine to the center of the acetabulum serves as the dividing line between anterior and posterior, and the bisecting line as the division between superior and inferior.

In cadaver studies, the posterior-superior and posterior-inferior quadrants were shown to have the thickest bone and best potential for obtaining secure fixation with the least risk for injury to vessels. The anterior-superior quadrant (the quadrant of death) and the anterior-inferior quadrant were shown to be the most dangerous quadrants for fixation due to the thin bone and close proximity of the vessels to bone in that region.Correct Answer: Anterior-superior and anterior-inferior

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323. (2466) Q1-2931:

What is the most commonly used surgical approach to the acetabulum:

1) Posterior
3) Anterior
2) Ilioinguinal
5) Anterolateral
4) Medial

The posterior approach to the acetabulum is the least technically demanding approach for total hip arthroplasty (THA) and offers good visualization of the acetabulum, especially of the posterior wall. The posterior approach is the most commonly used approach for THA in the United States. Patients are placed in the lateral position. The approach involves splitting of the gluteus maximus in line with its fibers and no internervous plane is present. The sciatic nerve is protected by the short external rotators after they are detached from their insertions on the femur and reflected medially.Correct Answer: Posterior

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324. (2467) Q1-2932:

In the ilioinguinal approach, what does the first window allow access to:

1) Pelvic brim and superior pubic ramus
3) Inferior pubic ramus and sciatic notch
2) Quadrilateral plate and retropubic space
5) Anterior sacroiliac joint, internal iliac fossa, and upper anterior column
4) Ilioschial tuberosity and retropubic space

The ilioinguinal approach provides improved visualization of the pelvic inner surface and anterior column and medial wall of the acetabulum. The patient is placed supine or in a lazy lateral decubitus position. The principle of this approach is to dissect closely along the inner wall of the pelvis and lift each muscular and neurovascular structure off of the bone. Three windows are present in this approach, each providing access to different structures. The first window allows access to the anterior sacroiliac joint, internal iliac fossa, and upper anterior column.Correct Answer: Anterior sacroiliac joint, internal iliac fossa, and upper anterior column

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325. (2468) Q1-2933:

The most sensitive method for identifying and quantifying the extent of osteolysis is:

1) Plain radiographs
3) Technetium-99m bone scanning
2) Magnetic resonance imaging
5) Helical computed tomography
4) Computed tomography

If extensive osteolysis is suspected, computed tomography is recommended because plain radiographs underestimate the extent of lysis. Helical computed tomography with metal artifact minimization is the most sensitive method for identifying and quantifying the extent of lysis.Correct Answer: Helical computed tomography

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326. (2469) Q1-2934:

The most common cause of vascular injury during total hip arthroplasty (THA) is:

1) Laceration
3) Arteriovenous fistula
2) Pseudoaneurysm
5) Thromboembolic phenomena
4) True aneurysm

A previous review of vascular injuries sustained during THA revealed the most common etiology of vascular injury as thromboembolic phenomena, followed by laceration, pseudoaneurysm, and arteriovenous fistula.Correct Answer: Thromboembolic phenomena

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327. (2470) Q1-2935:

The most common cause of damage to femoral vessels is:

1) Extruded cement
3) Capsule dissection
2) Migration of the acetabular cup
5) Screw placement
4) Aberrant retractor placement

Damage to the femoral vessels is most commonly due to aberrant retractor placement. Care should be taken to ensure that the retractor tip is placed directly on bone, and that the iliopsoas is not interposed between the retractor tip and bone. Extruded cement, acetabular cup migration, and capsule dissection have also been implicated in damage to the femoral vessels.Correct Answer: Aberrant retractor placement

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328. (2471) Q1-2936:

The risk of nerve injury following revision total hip arthroplasty (THA) is approximately:

1) 0.5%
3) 1% to 10%
2) 1%
5) More than 20%
4) 10% to 20%

Following primary THA, the incidence of nerve palsy is reported to be approximately 1.3%, but may be as high as 5.2% for primary THA performed for developmental dysplasia or dislocation. For revision surgery, the incidence may be as high as 7.6%.Correct Answer: 1% to 10%

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329. (2472) Q1-2937:

Slide 1

The most likely underlying diagnosis in this patient is:

1) Gout
3) Heterotopic ossification
2) Rheumatoid arthritis
5) Synovial chondromatosis
4) Pigmented villonodular synovitis

This radiograph presents a Brooker class IV heterotopic ossification in a 79-year-old woman after revision of a monopolar hemiarthroplasty to a press-fit, porous-coated acetabular component and a cemented femoral stem. The patient sustained a cerebrovascular accident 12 weeks before surgery. She had no other risk factors for heterotopic ossification formation after total hip arthroplasty. Other risk factors for heterotopic ossification include previous surgery, men with hypertrophic osteoarthritis, traumatic brain injury, spinal hyperostosis, and posttraumatic arthritis.Correct Answer: Heterotopic ossification

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330. (2473) Q1-2938:

Slide 1

This radiograph is most typical of:

1) Stress fracture
3) Osteitis pubis
2) Osteocarcinoma
5) Ewing's sarcoma
4) Osteomyelitis of the pubic symphysis

Osteomyelitis of the pubic symphysis is a rare condition, accounting for less than 1% of all acute hematogenous osteomyelitis cases. The condition is well described in elderly patients following urologic, gynecologic, and pelvic procedures. Osteomyelitis of the pubic symphysis has also been reported in intravenous drug abusers, after cardiac catheterization, and can occur spontaneously in athletes and children.Correct Answer: Osteomyelitis of the pubic symphysis

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331. (2474) Q1-2939:

Which of the following symptoms is least common in patients with osteomyelitis of the pubis:

1) Distal anterior pelvic pain
3) Rectus muscle spasm
2) Adductor muscle spasm
5) Wide-based waddling gait
4) Abductor muscle spasm

Osteomyelitis of the pubic symphysis is a rare condition, occurring in 2% to 11% of all patients with osteomyelitis of the pelvis. The osteitis pubis is the least affected area. Signs and symptoms of osteomyelitis of the pubic symphysis include distal anterior pelvic pain, adductor and rectus muscle spasms, and a wide-based waddling gait. Fever, leukocytosis, elevated erythrocyte sedimentation rate, and positive blood cultures may also be present. Unilateral rarefaction and sclerosis with cystic changes may be seen on radiographs 10 to 14 days after symptoms begin. Radionucleotide scans, computed tomography, and magnetic resonance imaging may aid in the diagnosis.Correct Answer: Abductor muscle spasm

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332. (2475) Q1-2940:

Common risk factors associated with extensor mechanism disruption after total knee arthroplasty (TKA) include all of the following except:

1) Limited preoperative range of motion
3) Medial parapateller exposure
2) Difficult surgical exposure
5) Obesity
4) Disruption of vascular supply to the patella

The etiology of extensor mechanism disruption after TKA is unknown. Researchers suggest that disruption of the vascular supply to the patella and patellar mechanism during the exposure may cause weakening of the patella and extensor mechanism. In addition, the frequency of extensor mechanism disruption has been reportedly increased in patients who have a preoperative limited range of motion or difficult surgical exposure.Correct Answer: Medial parapateller exposure

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333. (2476) Q1-2941:

Contributing factors causing female athletes to have more anterior cruciate ligament injuries than men include all of the following except:

1) Intercondylar notch width
3) Increased quadriceps angle
2) Ligament size
5) Fitness level
4) Strong overactive hamstrings

Female athletes are two to eight times more likely than men to sustain an anterior cruciate ligament injury when playing sports such as soccer, basketball, and volleyball. The exact etiology of gender-based injuries is unclear. Various intrinsic factors (intercondylar notch width, ligament size, quadriceps angle, joint laxity, hormonal effects) and extrinsic factors (muscular strength/weakness, fitness level, hamstring:quadriceps ratio) have been proposed as contributing factors. A strong hamstring actually protects the anterior cruciate ligament and is a preventative measure.Correct Answer: Strong overactive hamstrings

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334. (2477) Q1-2942:

The best results of hip fracture repair occur:

1) In the first 6 hours
3) Within the second day
2) Within the first day
5) Three days after repair
4) Within the third day

Medical consequences of time issues relevant to hip fractures have been examined by several authors. Operation within the first day of injury is superior and provides better results than delaying the procedure. However, the economic consequences of such a delay have not been examined.Correct Answer: Within the first day

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335. (2478) Q1-2943:

Slide 1

This T2-weighted sagittal magnetic resonance image of a right knee reveals:

1) Avascular necrosis of the distal femur
3) Anterior cruciate ligament rupture
2) Synovial sarcoma
5) Popliteal cyst
4) Posterior cruciate ligament rupture

Baker's or popliteal cyst, described first by Adams and later by Baker, is a distended bursa originating posterior to the medial head of the gastrocnemius muscle or semimembranous tendon and generally presents with posterior knee pain and a palpable mass. This case is unusual in that the dissection was proximal, unlike the typical distal progression of the popliteal cyst.Correct Answer: Popliteal cyst

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336. (2479) Q1-2944:

What is the main characteristic shift in the outcome assessment of total hip arthroplasty (THA) in the past decade:

1) Description of more technical details
3) Introduction of more hip prosthesis designs
2) Analysis and measurement of the impact and longevity of the procedure on a patient's quality-of-life
5) Decreasing number of dislocations
4) Introduction of new functional scoring systems

Over the past two decades, a continuous shift toward outcome assessment in medicine has occurred. Publications previously devoted to technical details and surgical technique have started analyzing and measuring the impact and longevity of medical procedures on patients' quality-of-life and have compared the cost-effectiveness of different procedures.Correct Answer: Analysis and measurement of the impact and longevity of the procedure on a patient's quality-of-life

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337. (2480) Q1-2945:

In the study design for evaluating the effectiveness of total hip replacement, the endpoint can be only:

1) Revision hip surgery
3) Any well-defined chosen point, such as revision hip surgery or functional level and pain
2) Radiographic loosening of the implant
5) Range of motion
4) Pain or functional level

In the study design, it is paramount that a universal, well-defined endpoint is chosen. In the well-established Scandinavian Hip Registries, this endpoint is revision total hip arthroplasty. Whether this endpoint is sensitive enough is debatable. For more in-depth studies, several other endpoints, such as pain or postoperative functional level, may also be used.Correct Answer: Any well-defined chosen point, such as revision hip surgery or functional level and pain

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338. (2481) Q1-2946:

The single most important criterion to identify the type of hip implant for future analysis in a hip arthroplasty register is:

1) The name of the manufacturer and the year of implant production
3) The implant's catalogue number provided by the manufacturer
2) The name of the implant and the year of implant production
5) The surgeon's name and implant manufacturer
4) The name of the manufacturer and implant

For the implanted prosthesis, manufacturer, name, material, and catalogue numbers are essential for precise future identification. The role of the catalogue numbers cannot be underestimated as successive generations of implants were put on the market with the same brand name (eg, Charnley hip). Without recording the catalogue numbers, it is impossible to determine what generation of implant is being compared to another.Correct Answer: The implant's catalogue number provided by the manufacturer

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339. (2482) Q1-2947:

The main advantage of multicenter studies in analyzing total hip arthroplasty is:

1) The inclusion of different surgeons
3) The ability to obtain a large number of patients
2) The inclusion of different countries
5) Giving more accurate data
4) The inclusion of different hip implants

The main advantage of multicenter studies - although they are time-consuming, expensive, and often frustrating - is obtaining large numbers of patients in a relatively short time. This is important when examining statistical differences between varying results.Correct Answer: The ability to obtain a large number of patients

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340. (2483) Q1-2950:

When comparing viral vectors with nonviral vectors for gene delivery, the advantages of nonviral vectors include all of the following except:

1) Safety
3) More efficiency
2) Less immunogenicity
5) Special packaging cell lines
4) Easier production

Because of the safety concerns, immunogenicity issues, and production complications associated with viral vectors, nonviral delivery systems were developed by complexing of genes (DNA) to various chemical formulations. Nonviral delivery systems stabilize DNA and increase its uptake and include plasmids, peptides, cationic liposomes, DNA-ligand complexes (recognize specific cell-surface receptors, leading to receptor-mediated uptake), and gene gun (particles of gold coated with DNA, forced into the cells with high velocity bombardment). However, nonviral vector efficiency is lower than viral vectors.Correct Answer: More efficiency

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341. (2484) Q1-2951:

All of the following have been used as viral vectors for gene delivery except:

1) Adeno-associated virus
3) Herpes simplex virus
2) Rotavirus
5) Retroviral vector
4) Lentivirus

A retroviral vector derived from the Moloney murine leukemia retrovirus is among the best-developed viral vectors. Other viral vectors include adenovirus, adeno-associated virus, and herpes simplex virus. Novel vector systems based on lentivirus, which is a type of retrovirus that includes human immunodeficiency virus, are being developed.Correct Answer: Rotavirus

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342. (2485) Q1-2952:

The principle of homologous recombination in gene therapy is used to:

1) Replace a defective gene by a wild-type gene
3) Supplement a wild-type gene
2) Suppress the expression of a mutant gene
5) Replace a defective gene by a normal gene
4) Alter the expression of a mutant gene

Novel approaches to treating genetic diseases involve gene repair or replacement rather than gene supplementation. One such approach is based on the principle of homologous recombination (replacement of a defective gene by a normal gene).Correct Answer: Replace a defective gene by a normal gene

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343. (2486) Q1-2953:

The virus associated with the most immune reactions is:

1) Adeno-associated virus
3) Adenovirus
2) Gutted adenovirus
5) Herpes simplex virus
4) Retrovirus

Adenoviral vectors can cause inflammatory reaction due to immune activation, an event linked to the first death related to gene therapy. This occurred in September 1999 at the University of Pennsylvania in a clinical trial in which an 18-year-old patient received infusion of more than a trillion adenoviral vectors directed to his liver, which triggered a systemic inflammatory response that became uncontrollable, leading to organ failure and death. Newer-generation gutted or gutless adenovirus vectors are nonimmunogenic.Correct Answer: Adenovirus

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344. (2487) Q1-2954:

Compared with the ex vivo gene delivery system, the in vivo system is:

1) Technically complex
3) Safer
2) Target specific
5) More invasive
4) Less invasive

Two basic strategies exist for gene delivery. Direct, or in vivo, gene therapy involves direct introduction of vectors into the body. Indirect, or ex vivo, gene therapy involves removal of target cells from the body, vector introduction by incubation of the cells in vitro, and reimplantation. The in vivo system is less invasive.Correct Answer: Less invasive

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345. (2488) Q1-2955:

The gene that has been studied in greatest detail for application in osteoarthritis is:

1) p53
3) Tissue inhibitors of metalloproteinases-4
2) Interleukin (IL)-13
5) Bone morphogenetic protein-2
4) IL-1 receptor antagonist

Gene therapy has been suggested as a means of delivering sustained therapeutic levels of anti-arthritis gene products to diseased joints. Local gene delivery to the synovial tissue is the approach of choice for osteoarthritis and other conditions affecting a few joints. Gene therapy is less suited to address the extra-articular components of systemic conditions, such as rheumatoid arthritis.

The gene that has been studied in greatest detail encodes the human IL-1 receptor antagonist.

Correct Answer: IL-1 receptor antagonist

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346. (2489) Q1-2956:

The osteoinductive potential of LIM mineralization protein (LMP)-1 gene has been studied for clinical application in:

1) Fracture repair
3) Cartilage regeneration
2) Spinal fusion
5) Meniscal injury
4) Ligament healing

Identification of LMP-1, a novel intracellular protein, is a step forward in osteoinductive proteins. Unlike bone morphogenetic protein, which is a secreted protein that binds to cell-surface receptor to initiate a response, LMP-1 is an intracellular signaling molecule. Boden and colleagues transfected bone marrow cells from rats ex vivo with LMP-1 gene using DNA plasmid vector and used them during posterior thoracic and lumbar spinal fusion in rats.Correct Answer: Spinal fusion

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347. (2490) Q1-2957:

The gene studied for application in osteoporosis and wear-induced osteolysis is:

1) Osteoprotegerin
3) Transforming growth factor-Ã1
2) Bone morphogenetic protein
5) Interleukin (IL)-receptor antagonist
4) LIM mineralization protein

Various cytokines and cytokine antagonists hold promise as new therapeutic agents for osteoporosis. Baltzer and colleagues showed that intramedullary injection of Ad-IL-1Ra gene in a murine ovariectomy model strongly reduced the loss of bone mass. Using a similar model, Bolon and associates studied the effect of adenovirus-mediated transfer of osteoprotegerin, which showed more bone volume with reduced osteoclast numbers in axial and appendicular bones after 4 weeks compared with sham-operated mice.Correct Answer: Osteoprotegerin

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348. (2491) Q1-2958:

Gene transfer to a cell using viral vectors is called:

1) Transduction
3) Transformation
2) Transfection
5) Augmentation
4) Conjugation

In vivo gene delivery involves the direct injection of vectors containing the genes into the body with the expectation that they will reach and transduce the target cell. Ex vivo gene delivery is a process whereby the target cells are removed from the body, genetically altered in vitro, and reimplanted into the body.Correct Answer: Transduction

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349. (2492) Q1-2959:

Which of the following genes has been shown to stimulate proteoglycan synthesis for prevention of disk degeneration:

1) LIM mineralization protein
3) Decorin
2) Bone morphogenetic protein-7
5) Osteoprotegerin
4) Transforming growth factor (TGF)-Ã1

Intervertebral disk degeneration has been associated with a progressive decrease in proteoglycan content of nucleus pulposus. The potential application of gene therapy for prevention of disk degeneration is to increase or maintain the proteoglycan content of nucleus pulposus. Thompson and colleagues reported that addition of TGF-Ã1 to canine disk tissue in culture stimulated in vitro proteoglycan synthesis.Correct Answer: Transforming growth factor (TGF)-Ã1

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350. (2552) Q1-3024:

The advantages of an arthroscopic-assisted rotator cuff repair include all of the following except:

1) The surgeon can approach the shoulder from multiple angles.
3) Operative time is shorter.
2) The deltoid attachment is preserved.
5) As opposed to other repair methods, a better early range of motion is achieved.
4) Postoperative rehabilitation is accelerated.

Arthroscopy facilitates a thorough assessment and treatment of a rotator cuff tear by approaching the shoulder from multiple angles. It preserves the deltoid attachment to the acromion and postoperative rehabilitation is potentially accelerated if the deltoid does not need to be protected. Arthroscopy achieves a better early range of motion than other repair methods; however, it requires a longer operative time.Correct Answer: Operative time is shorter.

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351. (4054) Q1-3025:

The disadvantages of a complete arthroscopic repair of a rotator cuff include all of the following except:

1) Complete arthroscopic repair limits some suture configuration options in the tendon.
3) Complete arthroscopic repair is technically difficult to perform.
2) Postoperative pain is increased.
5) Operative time is longer.
4) Complex instrumentation is required.

Arthroscopic repair techniques generally require the use of suture anchors and limit some suture configuration options in the tendon. Complete arthroscopic repair is technically difficult, requires significantly greater and more complex instrumentation, and has a potentially longer operative time. However, it decreases postoperative pain.Correct Answer: Postoperative pain is increased.

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352. (2553) Q1-3026:

The types of rotator cuff tear patterns are:

1) Crescent-shaped and massive contracted immobile tears
3) Vertical and horizontal cleavage tears
2) U-shaped and L-shaped tears
5) Vertical cleavage, U-shaped, and L-shaped tears
4) Crescent-shaped, U-shaped, L-shaped, and massive contracted immobile tears

Four major types of rotator cuff tear patterns have been described and are based on the shape and mobility of the tear margins: crescent-shaped, U-shaped, L-shaped, and massive contracted immobile tears. Vertical and horizontal cleavage tears are related to meniscal tears in the knee.Correct Answer: Crescent-shaped, U-shaped, L-shaped, and massive contracted immobile tears

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353. (2554) Q1-3027:

Which of the following rotator cuff tears is the simplest to repair:

1) U-shaped tear
3) Crescent-shaped tear
2) L-shaped tear
5) Parrot-beak tear
4) Vertical cleavage tear

Crescent-shaped tears are the simplest of all tears to repair and demonstrate minimal retraction and excellent mobility. They can be repaired directly to the bone with minimal tension. The anchors are placed percutaneously using a spinal needle. Suture passing techniques are then used and the rotator cuff is tied down. Vertical cleavage and parrot-beak tears refer to meniscal injuries in the knee.Correct Answer: Crescent-shaped tear

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354. (2555) Q1-3028:

Slide 1

The following image depicts:

1) An arthroscopic view of a massive rotator cuff tear
3) An arthroscopic view of a U-shaped rotator cuff tear
2) An arthroscopic view of an L-shaped rotator cuff tear
5) An arthroscopic view of a medial meniscus tear of the knee
4) An arthroscopic view of a crescent-shaped rotator cuff tear

The image depicts a lateral arthroscopic view of a crescent-shaped tear, which demonstrates minimal retraction and excellent mobility, and is easily repaired.Correct Answer: An arthroscopic view of a crescent-shaped rotator cuff tear

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355. (2556) Q1-3029:

Slide 1

The following image depicts:

1) A lateral arthroscopic view of a massive U-shaped tear of the rotator cuff
3) A lateral arthroscopic view of an L-shaped tear of the rotator cuff
2) A lateral arthroscopic view of a crescent-shaped tear of the rotator cuff
5) A bucket-handle tear of the medical meniscus
4) A degenerative posterior horn tear of the medial meniscus

The image depicts a lateral arthroscopic view of a massive U-shaped tear. U-shaped rotator cuff tears extend much farther medially than crescent-shaped tears, with the apex of the tear adjacent to or medial to the glenoid rim.Correct Answer: A lateral arthroscopic view of a massive U-shaped tear of the rotator cuff

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356. (2557) Q1-3030:

All of the following are static restraints providing stability for the shoulder except:

1) Labrum
3) Glenohumeral ligaments
2) Glenoid
5) Joint capsule
4) Rotator cuff and scapular muscles

The shoulder allows more range of motion than any other joint in the body and is susceptible to injury. It has both static and dynamic restraints. The rotator cuff and scapular muscles are the dynamic restraints. The glenoid, labrum, glenohumeral ligaments, and joint capsule are the static restraints.Correct Answer: Rotator cuff and scapular muscles

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357. (2558) Q1-3031:

Which of the following provides the greatest restraint to anterior dislocation of the shoulder:

1) Superior glenohumeral ligament
3) Infraspinatus
2) Supraspinatus
5) Joint capsule
4) Inferior glenohumeral ligament

The inferior glenohumeral ligament provides the greatest restraint to dislocation of the shoulder. The inferior glenohumeral ligament is under the most stress at 90Â° of abduction with external rotation and extension. Bracing to restrict this position benefits a patient with instability.Correct Answer: Inferior glenohumeral ligament

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358. (2559) Q1-3032:

The percentage of patients 20 to 40 years of age who have recurrent shoulder instability is:

1) 10%
3) 40%
2) 20%
5) 60%
4) 50%

Suffering from recurrent instability in the shoulder joint depends on a patientâs age and activity level. Ninety percent of patients younger than 20 years of age have recurrent instability. In patients 20 to 40 years of age, 40% have recurrent instability.Correct Answer: 40%

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359. (2560) Q1-3033:

The percentage of athletes with recurrent instability choosing to return to collision sports after an anterior shoulder dislocation is:

1) 20%
3) 60%
2) 40%
5) 100%
4) 80%

A patientâs activity level is the predicting factor for recurrent instability. Eighty-two percent of athletes suffer from recurrent instability compared with 30% of nonathletes. The percentage approaches 100% for athletes choosing to return to collision sports.Correct Answer: 100%

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360. (2561) Q1-3034:

The most frequently transplanted human tissue is:

1) Bone
3) Kidney
2) Blood
5) Skin
4) Cornea

After blood, bone is the most frequently transplanted human tissue. However, bone autografting may eventually become a thing of the past. Bone replacement with synthetic materials and growth factors is becoming common procedure in the orthopedic operating room.Correct Answer: Blood

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361. (2562) Q1-3035:

The first documented bone transplant was performed by:

1) Van Meekeren
3) Phemister
2) Macewan
5) Albee
4) Ferguson

The first documented bone transplant was performed in 1668 by Dutch surgeon Job van Meekeren, when he used a dog cranium (a xenograft) to repair a soldierâs skull defect. Scottish surgeon William Macewan performed the first bone allograft in 1880 when he replaced the infected humerus of a 4-year-old boy with a tibia graft taken from a child with rickets. In his 1914 publication, Phemister noted the importance of âhemostasis, asepsis, and coaptation of partsâ in successful bone grafting. Phemister and Albee elucidated the important factors in bone grafting in the early 20th century, paving the way for the recent work that has delineated the importance of osteoconductive scaffolding, osteoinductive growth factors, and osteogenic progenitor stem cells in bone graft healing.Correct Answer: Van Meekeren

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362. (2563) Q1-3036:

In most clinical applications, a bone autograft is preferable to a bone allograft because:

1) A bone autograft is more osteoconductive, osteoinductive, and osteogenic than a bone allograft.
3) A bone autograft incorporates more slowly than a bone allograft.
2) A bone autograft has a higher risk of infection than a bone allograft.
5) There are more immunological considerations.
4) Bone autografts are in limitless supply.

Autografting is the standard method used to replace bone loss due to trauma, infection, tumor resection, revision arthroplasty, and arthrodesis. Rapid incorporation and consolidation with the lack of immunological considerations make bone harvested from the patient ideal. Bone autografts are osteoconductive and contain osteoinductive proteins and cells, which are able to give rise to bone-forming cells. Because of its lower risks, a bone autograft (especially of cancellous bone) is preferable to a bone allograft. Bone autografts, however, are in limited supply, particularly in children.Correct Answer: A bone autograft is more osteoconductive, osteoinductive, and osteogenic than a bone allograft.

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363. (2564) Q1-3037:

When nonvascularized cortical allografts lose mechanical strength during the first year following surgery, it is most likely due to:

1) Revascularization
3) Infection
2) Failure of the graft to incorporate
5) Failure to provide initial structural support
4) Complex regional pain syndrome

Nonvascularized cortical grafts may provide immediate structural support but lose mechanical strength over the first few months. Loss of mechanical strength is due to the revascularization process, which causes osteoporosis and subsequent graft weakening. The process requires resorption of at least some graft bone to allow ingrowth of blood vessels and takes a significantly longer period of time in cortical bone than in cancellous bone.Correct Answer: Revascularization

---

364. (2565) Q1-3038:

What percentage of osetocytes present in a vascularized cortical autograft survive:

1) 24%
3) 60%
2) 40%
5) 90%
4) 80%

Vascularized cortical autografts are effective structural grafts that heal quickly without the revascularization process and consequent mechanical compromise found in avascular cortical autografts and allografts. Typically, more than 90% of osteocytes present in a vascularized cortical allograft survive transplantation and bring their own blood supply, perhaps making the contribution of the recipient bed tissues less important than healing.Correct Answer: 90%

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365. (2566) Q1-3039:

Vascularized free fibular grafts have been used to treat all of the following except:

1) Congenital pseudoarthrosis of the tibia
3) Osteonecrosis of the femoral head
2) Tumor-related defects in the proximal humerus
5) Nonunions of the femur
4) Pseudoarthrosis of the scaphoid

Vascularized free fibula grafts have been used in numerous locations for a variety of difficult problems. Potential situations in which a patient might benefit from vascularized autografts include osteonecrosis of the femoral head, reconstruction of tumor-related defects in the proximal humerus and lower extremity, treatment of congenital tibial pseudoarthrosis, and nonunions of the femur, tibia, and femoral neck.Correct Answer: Pseudoarthrosis of the scaphoid

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366. (2567) Q1-3040:

Demineralized bone matrix is:

1) Osteogenic
3) Osteoinductive, osteogenic, and osteoconductive
2) Osteogenic and osteoconductive
5) Only osteoconductive
4) Osteoconductive and osteoinductive

Demineralized bone matrix is recognized as having a variable amount of osteoinductive capacity and some osteoconductive properties. The biologic activity varies with specific processing and storage methods, in addition to variation among donors.Correct Answer: Osteoconductive and osteoinductive

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367. (2568) Q1-3041:

Which of the following has the highest risk of disease transmission:

1) Cortical allograft
3) Cancellous allograft
2) Cortical autograft
5) Cortical allograft and cancellous allograft have the same risk of disease transmission.
4) Cancellous autograft

Cortical bone is of greater density than cancellous bone, and it is believed that the density accounts for the slightly higher risk of disease transmission, as pathogens are less easily destroyed when embedded in a more dense tissue bed. Two cases of HIV transmission resulting from cortical allografts have been reported.Correct Answer: Cortical allograft

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368. (2569) Q1-3042:

Slide 1 **Slide 2**

The following image (Slide 1) depicts:

1) The removal of congenital pseudoarthrosis of the tibia
3) A fibular autograft
2) A vascularized iliac autograft
5) A fibular autograft for spinal fusion
4) The harvesting of the vascularized fibula from the contralateral leg

The image depicts the harvesting of a vascularized fibula from the contralateral leg, which is then used to move a defect in congenital pseudoarthrosis of the tibia on the opposite side. The following image (Slide 2) shows clinical union 3.5 years later.Correct Answer: The harvesting of the vascularized fibula from the contralateral leg

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369. (2570) Q1-3043:

Vascularized transplantation of the knee and femoral diaphysis is most frequently complicated by:

1) Immunosuppressive medications
3) Bony nonunions
2) Pulmonary emboli
5) Deep venous thrombosis (DVT)
4) Acute infections

Hofmann and Kirschner reported their experiences with transplantation of vascularized diaphyseal femora and vascularized knees. While using an immunosuppressive regimen consisting of antithymocyte globulin, cyclosporine, azathioprine, and methylprednisolone, which was tapered over 6 months to cyclosporine monotherapy, three patients underwent transplantation of vascularized femoral diaphysis and five patients underwent transplantation of the entire knee, including the extensor mechanism and joint capsule. According to their most recent report, four of these eight patients (two from each group) are currently weight bearing on their transplants. As the authors state, these vascularized bone transplants were âfraught with complications,â largely related to the immunosuppressive medications.Correct Answer: Immunosuppressive medications

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370. (2636) Q1-3127:

When treating an infected joint prosthesis with antibiotic cement, the antibiotic elution should stay above the minimum inhibitory concentration (MIC) for a minimum of:

1) 1 week
3) 3 weeks
2) 2 weeks
5) 6 weeks
4) 4 weeks

Antibiotic elutions differ among brands of cement. However, the antibiotic concentrations should stay above the MIC for at least 3 weeks. The effect is local and there is no significant absorption of a specific antibiotic out of the bone cement and into the plasma.Correct Answer: 3 weeks

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371. (2637) Q1-3128:

After implantation, the antibiotic inside bone cement will be present and can be measured for up to:

1) 1 day
3) 2 weeks
2) 1 week
5) Several months
4) 3 weeks

The antibiotic inside bone cement will be present in the bone cement for months or even years after implantation into a patient. Antibiotic has been measured present even after 5 years.Correct Answer: Several months

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372. (2638) Q1-3129:

The chances of an arthroplasty revision becoming re-infected by a different organism or the initial infection after a two-stage revision is approximately:

1) 5%
3) 20%
2) 10%
5) 50%
4) 40%

In one series, 23% of arthroplasty revisions became re-infected by a different organism even after a two-stage revision. However, re-infection is usually, although not always, caused by the same microorganism that caused the initial infection. Once the white blood cell count, sedimentation rate, and C-reactive protein count return to normal, it is usually safe to re-implant the prosthesis.Correct Answer: 20%

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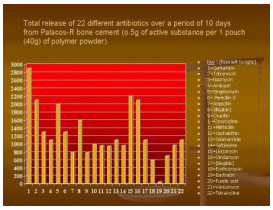
373. (2639) Q1-3130:



Slide 1

Which of the following antibiotics has the highest concentration locally from Palacos-R (Biomet, Warsaw, IN) cement:

1) Tobramycin
3) Bacitracin
2) Lincomycin
5) Keflex
4) Gentamicin

The Slide represents different antibiotics that may be used with bone cement and the release of antibiotics over a 10-day period. Gentamicin leads the way with a high concentration locally. Bacitracin, for instance, does not leach in high concentrations from Palacos-R bone cement.Correct Answer: Gentamicin

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374. (2640) Q1-3131:

The maximum amount of antibiotic powder that can be added as a temporary spacer to 40 g of cement powder is:

1) 1 g
3) 4 g
2) 2 g
5) 9 g to 10 g
4) 6 g to 8 g

Surgeons should not add more than 6 g to 8 g of antibiotic powder per 40 g of cement powder. One also needs to be careful when adding additional antibiotic powder of the same type, especially to Palacos-R (Biomet, Warsaw, IN) cement, as an overdose may occur. The cement powder should be mixed with the liquid and then the antibiotic powder added to facilitate setting of the cement.Correct Answer: 6 g to 8 g

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375. (2641) Q1-3132:

The optimal depth of cement penetration for prosthesis insertion is:

1) 1 mm
3) 3 mm
2) 2 mm
5) 8 mm
4) 4 mm

Pressure magnitude is the most influential of all factors considered in cement penetration behavior. The optimal depth of cement penetration is 4 mm. The higher the pressure is inside the femoral canal, the more effectively the cement will interdigitate.Correct Answer: 4 mm

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376. (2642) Q1-3133:

Which of the following most effectively provides the strongest fixation when cementing a prosthesis in a femur:

1) A thin cancellous layer
3) A poor quality cancellous layer
2) No cancellous layer at all
5) A straight-stem femoral prosthesis
4) High-quality, radiodense cancellous bone

The most effective way to provide the strongest fixation when cementing a prosthesis in a femur is to insert it into high-quality, radiodense cancellous bone using a tapered femoral stem, which creates higher intramedullary pressures than a straight stem.Correct Answer: High-quality, radiodense cancellous bone

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377. (2643) Q1-3134:

Which of the following is not a risk factor for fracturing cement around a prosthesis:

1) A sharp corner in the metal
3) A thick cement mantle
2) A cement mantle less than 3 mm thick
5) Local debonding of the cement-metal interface
4) Voids or air bubbles in the cement mantle

Sharp corners in the metal act as chisels and, as time goes by, are driven into the cement causing cracks. A cement mantle less than 3 mm thick, voids or air bubbles in the cement mantle, and local debonding of the cement-metal interface are also risk factors. A thick cement mantle of 4 mm or greater is desired because a thin mantle cannot sustain the prosthesis.Correct Answer: A thick cement mantle

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378. (2644) Q1-3135:

To obtain an adequate cement penetration of 4 mm at a pressure of 0.2 MPA to 0.3 MPA in arthritic bone, one needs to maintain:

1) 10 kg of pressure for 20 seconds
3) 30 kg of pressure for 30 seconds
2) 20 kg of pressure for 30 seconds
5) 50 kg of pressure for 50 seconds
4) 40 kg of pressure for 30 seconds

To extrapolate the above to the clinical situation, one must maintain a force of 40 kg to 60 kg of pressure for at least a period of 40 to 60 seconds. Adequate penetration of less than 40 kg of pressure for less than 40 seconds does not give adequate cement penetration.Correct Answer: 50 kg of pressure for 50 seconds

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379. (2645) Q1-3136:

Which of the following commercially available cements has the lowest tensile strength value:

1) Palacos-R (Biomet, Warsaw, IN)
3) Simplex P (Stryker, Kalamazoo, MI)
2) Sulfix-60 (Sulzer, Austin, TX)
5) Zimmer Dough (Zimmer, Warsaw, IN)
4) CMW3 (Wright Medical Technology, Inc, Arlington, TN)

Zimmer Dough has the lowest value of tensile strength; however, all of the above are FDA-approved cements and of sufficient quality.Correct Answer: Zimmer Dough (Zimmer, Warsaw, IN)

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380. (2646) Q1-3137:

Which of the following bone cements has demonstrated the lowest cycles to failure:

1) Simplex P (Stryker, Kalamazoo, MI)
3) Boneloc (Biomet, Warsaw, IN)
2) Palacos-R (Biomet, Warsaw, IN)
5) Sulfix-60 (Zimmer, Warsaw, IN)
4) Zimmer Dough (Zimmer, Warsaw, IN)

Simplex P and Palacos-R display outstanding results when tested in the cyclic conditions. Boneloc demonstrated the lowest cycles to failure.Correct Answer: Boneloc (Biomet, Warsaw, IN)

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381. (2647) Q1-3138:

The most significant factor reducing porosity in bone cement is:

1) Storage temperature only
3) Vacuum-mixing medium viscosity
2) Centrifugation of low viscosity cement
5) Vacuum-mixing only
4) A combination of vacuum-mixing and centrifugation

The most significant factor reducing porosity in bone cement is a combination of centrifugation and vacuum-mixing. If cement is centrifuged and vacuum-mixed, then low viscosity cement is not significantly different from medium viscosity cement. A comparison of storage temperatures at 4Â° C and 21Â° C shows little effect on cement bubbles or cement voids, or porosity of bone cement.Correct Answer: A combination of vacuum-mixing and centrifugation

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382. (2648) Q1-3139:

Prosthetic placement in a cement-filled canal creates highest peak elevations in pressure when:

1) Using a cement restrictor
3) Using mechanical pressurization
2) Using a retrograde filling
5) Inserting the prosthesis early, while the cement is extremely soft
4) Inserting the prosthesis late in the setting phase

Prosthetic placement in the cement-filled femoral canal creates transiently higher peak elevations in pressure when inserted late in the setting phase. It creates higher pressures than those obtained with a cement restrictor, retrograde filling, or mechanical pressurization.Correct Answer: Inserting the prosthesis late in the setting phase

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383. (2649) Q1-3140:

The time it takes for the polymer/monomer mixing until polymerization is sufficient to maintain the implant in its correct position is known as:

1) Doughing time
3) Setting time
2) Working time
5) Polymerization time
4) Mixing time

The setting process is described by three critical time periods, which include doughing time, working time, and setting time. The doughing time begins when the polymer and the monomer are mixed until the time when the mixture will not adhere to a gloved hand anymore. Working time implies the time from the start of kneading until the cement is too stiff to be delivered in the bone. The setting time implies the time from the polymer/monomer mixing until polymerization is sufficient to maintain the correct implant position.Correct Answer: Setting time

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384. (2650) Q1-3141:

Cement takes longer to set when using a:

1) Roughened stem
3) Polished femoral stem
2) Precoated femoral stem
5) Cement setting time is not affected by the femoral stem.
4) Irregular femoral stem

Cement sets sooner when using a roughened or precoated femoral stem. It sets later when using a finely polished femoral stem because the cement-prosthesis bond is not influenced by the wetness of the cement.Correct Answer: Polished femoral stem

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385. (2651) Q1-3142:

Acrylic bone cement is composed of:

1) A polymer powder and a polymer liquid component
3) A polymer powder and a monomer liquid component
2) A monomer powder and a monomer liquid component
5) Polymethylmethacrylate (PMMA) only
4) A monomer powder and a polymer liquid component

Polymethylmethacrylate (PMMA) is one of the ingredients of acrylic bone cement. The two components of bone cement are a polymer powder component and a monomer liquid component. A blend of ingredients in the polymer and monomer (which includes PMMA) gives cement its unique characteristics.Correct Answer: A polymer powder and a monomer liquid component

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386. (2652) Q1-3143:

The chemical composition of acrylic bone cement is:

1) Benzoyl peroxide and barium sulfate
3) Methylmethacrylate-styrene-copolymer and polymethylmethacrylate
2) Methylmethacrylate-styrene-copolymer
5) Polymethylmethacrylate and dimethyl-p-toluidine
4) Methylmethacrylate-styrene-copolymer, polymethylmethacrylate, and barium sulfate

When the monomer liquid is added to the polymer powder, the polymer powder dissolves and releases benzoyl peroxide from the polymer. The benzoyl peroxide initiates a reaction with n,n-dimethyl-p-toluidine in the monomer, which accelerates the chemical reaction and polymerization. When complete, acrylic bone cement is composed of 75% methylmethacrylate-styrene-copolymer, 15% polymethylmethacrylate, and 10% barium sulfate.Correct Answer: Methylmethacrylate-styrene-copolymer, polymethylmethacrylate, and barium sulfate

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387. (2653) Q1-3144:

Bone cement was first used commercially:

1) During World War II in the production of airplane windshields
3) By John Charnley for bonding total hip joints to bone
2) In dentistry for filling cavities
5) As a base material for dentures
4) By neurosurgeons for replacement of skull defects

Otto Rohm, MD, developed polymethylmethacrylate and introduced it into commercial application. In the 1930s, bone cement was first used commercially as a base material for dentures.Correct Answer: As a base material for dentures

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388. (2654) Q1-3145:

The longest period of survival for cemented total joints is associated with which type of cementation technique:

1) Grade A
3) Grade C1
2) Grade B
5) Grade D
4) Grade C2

The grade A cementation technique is the most advantageous and is associated with the longest period of survival in total joint replacement. One cannot clearly distinguish between the edge of the cement and the edge of the surrounding bone.Correct Answer: Grade A

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389. (2655) Q1-3146:

Which of the following prosthetic areas is classified as a grade 4 Gruen zone radiographic defect:

1) The medullary distal tip of the prosthesis and the cement
3) The lateral lower third of the prosthesis
2) The lateral middle part of the prosthesis
5) The middle part, medial of the prosthesis
4) The medial distal third of the prosthesis

Gruen zones are an effective international classification system whereby radiographic defects or errors are evaluated and documented according to zones around a prosthesis. The classification begins with grade 1, which is lateral in the area of the greater trochanter to just below the lesser trochanter. Grade 4 is a radiographic defect located at the medullary distal tip of the prosthesis and the cement.Correct Answer: The medullary distal tip of the prosthesis and the cement

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390. (2656) Q1-3147:

Which of the following grades classifies the mode of failure of cemented femoral components in which the whole proximal part of the prosthesis is denude of bone cement and rocks back and forth in the distal part that is fixed with bone cement:

1) Grade Ia
3) Grade III
2) Grade II
5) Grade Ib
4) Grade IV

Modes of failure of cemented femoral components are classified into four grades. In a grade Ia, subsidence of the metal prosthesis in the cement mantle is present. Grade Ib implies that the cement and stem are pistoning distalward. Grade II implies medial migration of the proximal stem and lateral migration of the distal stem. Grade III is classified by a pivot of the calcar part of the prosthesis. Grade IV implies that the whole proximal part of the prosthesis is denude of bone cement and rocks back and forth in the distal part that is fixed with bone cement.Correct Answer: Grade IV

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391. (2657) Q1-3148:

Which of the following latex-free gloves are destroyed by bone cement:

1) Allegard latex-free gloves (Johnson & Johnson, New Brunswick, NJ)
3) Neotech (Regent Medical)
2) Biogel (Regent Medical, Norcross, GA)
5) No latex-free gloves are destroyed by bone cement.
4) Duraprene

Not all brands of latex-free gloves are equally effective. Bone cement destroys Allegard latex-free gloves.Correct Answer: Allegard latex-free gloves (Johnson & Johnson, New Brunswick, NJ)

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392. (2658) Q1-3149:

Which of the following is not a factor in the setting time of cement:

1) Storage temperature of bone cement
3) Handling and kneading of bone cement
2) Ambient temperature
5) Introducing bone cement in a warm environment
4) Use of a cement gun

Storage temperature, ambient temperature, handling and kneading of bone cement, and introducing cement in a warm environment are factors of the setting time of cement. Use of a cement gun is not a factor.Correct Answer: Use of a cement gun

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393. (3067) Q1-3575:

With the use of perineural catheters, improvement in all of the following outcomes can be anticipated except:

1) Lower pain scores
3) Reduced incidence of nausea and vomiting
2) Narcotic sparing effect
5) Shortened length of stay
4) Increased sleep disturbances

Double blind placebo controlled randomized trials the use of perineural catheters led to improved pain scores, decreased narcotic usage and narcotic related side effects, and fewer sleep disturbances.

Length of stay was shortened by the use of perineural catheters as compared to epidural or IV PCA analgesia in several studies. In pilot studies, the use of perineural catheters in carefully selected patients allowed ambulatory total shoulder arthroplasty and single day admissions for total hip arthroplasty and total knee arthroplasty.Correct Answer: Increased sleep disturbances

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394. (3068) Q1-3576:

The addition of a sciatic nerve block to a femoral nerve block will:

1) Enhance analgesia following knee surgery
3) Provide complete anesthesia to the knee
2) Improve mobility
5) Decrease DVT formation
4) Increase the likelihood of nerve injury

Pain from the posterior aspect of the knee joint is diminished with the addition of a sciatic nerve block to complement a femoral nerve block.

The use of combined femoral sciatic nerve block impairs ambulation because of the degree of extensive motor block of the quadriceps and muscles of the lower leg. In addition, proprioception that aids in balance is diminished with peripheral nerve block.

The obturator nerve, which contributes to the innervation of the knee capsule, is more frequently anesthetized with a lumbar plexus (posterior approach) than an anterior femoral nerve block. Because of the variability of the cutaneous innervation of the obturator nerve, the only reliable test for measuring obturator nerve block is motor block of the adductors of the thigh. The addition of a sciatic nerve block will not improve obturator nerve blockade.

Nerve injury after peripheral nerve block of lower extremity is uncommon (<1 in 5,000). The incidence is no higher after combined femoral sciatic nerve blocks than after single nerve blocks.

Theoretically, the likelihood of DVT formation should be decreased in patients receiving a combined femoral and sciatic nerve blocks compared to patients who receive no regional anesthesia because of the profound degree of vasodilatation induced by the sympathetic block to the lower extremity. To date, no large studies have been performed to prove or disprove this theoretical advantage.

Correct Answer: Enhance analgesia following knee surgery

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395. (3238) Q1-4060:

What percent of asymptomatic osteonecrosis (Stage I Steinberg) with steroid use, alcohol abuse, or an idiopathic etiology progress to painful symptoms:

1) 10%
3) 50%
2) 30%
5) 90%
4) 70%

In several combined studies that involved 83 asymptomatic stage 1 osteonecrosis of the femoral head associated with steroid use, alcohol abuse, or idiopathic etiology, only 27 (33%) hips progressed to symptoms after 6 to 36 months.

TABLE II. Review of the Literature of the Evolution for other Asymptomatic Stage-I Hips Treated Nonoperatively

Study	Number of Hips	Duration of Follow-up(mo)	Symptomatic Progression
Stulberg et al	3	26.8	2 of 3
Kopecky et al	25	16	7 of 25
Takatori et al	32	20.9	14 of 32
Fordyce and Solomon	5	36	2 of 5
Mulliken et al	11	22	0 of 11
Davidson	7	6.5	2 of 7
Total			27 of 83

Correct Answer: 30%

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396. (3239) Q1-4061:

In addition to developing pain, what percent of patients with asymptomatic osteonecrosis and sickle cell disease will have hips that collapse:

1) 10%
3) 50%
2) 30%
5) 90%
4) 70%

Seventy-seven percent of 121 asymptomatic hips studied by Hernigou and colleagues went on to collapse. Their results suggest that patients with sickle cell disease with asymptomatic stage I and II osteonecrosis is more rapid and frequent than previously assumed with osteonecrosis related to steroid or alcohol use.Correct Answer: 70%

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397. (3240) Q1-4062:

Which of the following percentages represents the number of patients with homozygous sickle cell disease that will develop osteonecrosis of the femoral head by age 35:

1) 10%
3) 50%
2) 30%
5) 90%
4) 70%

Osteonecrosis of the femoral head is a common complication in patients with sickle cell disease, and the prevalence of complications peaks in adolescence. Osteonecrosis of the femoral head develops by the age of 35 in nearly half of all patients with homozygous sickle cell disease.Correct Answer: 50%

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398. (3241) Q1-4063:

Bilateral hip involvement with osteonecrosis is seen in what percent of patients with sickle cell disease:

1) 5%
3) 20%
2) 10%
5) 50%
4) 30%

Bilateral hip involvement in patients with sickle cell disease with osteonecrosis is found in 40% to 90% of all patients. Without intervention, the rate of femoral head collapse in patients with sickle cell disease is 87% within 5 years after initial diagnosis of the osteonecrosis, but it can be as high as 90% within 2 years after the initial diagnosis.Correct Answer: 50%

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399. (3242) Q1-4064:

Failure rates, based on pain and limitation of motion, after total hip replacements (THR) in patients with sickle cell disease is:

1) 10%
3) 50%
2) 25%
5) 90%
4) 75%

Seventy-five percent of patients with sickle cell disease who had undergone THR were found to have ongoing pain and substantial limitation of motion. Because of these unfavorable results, there is considerable interest in evaluating treatment regimens that will postpone the need for THR in this population.Correct Answer: 75%

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400. (3243) Q1-4066:

What is the prevalence of sickle cell disease among African Americans:

1) 1/6
3) 1/600
2) 1/60
5) 1/60,000
4) 1/6000

Sickle cell disease denotes all genotypes containing one sickle cell gene and another variant hemoglobin encoding gene (eg, HbC, HbS, HbD). These result in phenotypes where HbS constitutes at least 50% of the present hemoglobin. It is estimated that 1 of every 600 African Americans has sickle cell disease. Six major subsets of sickle cell disease exist, with mutation type determining disease severity.Correct Answer: 1/600

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401. (3244) Q1-4067:

In patients with sickle cell disease, what are the most commonly affected locations for osteonecrosis:

1) Distal radial and distal humerus
3) Distal femur and proximal tibia
2) Head of femur and head of humerus
5) Metacarpals and phalanges
4) Head of humerus and proximal tibia

The prevalence of osteonecrosis in patients with sickle cell disease is as high as 37% to 50%. Osteonecrosis most commonly occurs in the humeral and femoral heads, due to their limited arterial network, which can easily succumb to occlusion by sickled cells.Correct Answer: Head of femur and head of humerus

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402. (3245) Q1-4068:

Appropriate indications for preoperative transfusion therapy in patients with sickle cell include:

1) Hemoglobin <5g/dL with clinical signs/symptoms of anemia.
3) Acute chronic anemia with severe aplastic anemia.
2) Pulmonary acute chest syndrome with multisegmental disease or hypoxia.
5) Hemoglobin <5g/dL with clinical signs/symptoms of anemia, acute chronic anemia with severe aplastic anemia, and pulmonary acute chest syndrome with multisegmental disease or hypoxia.
4) Hemoglobin <5g/dL with clinical signs/symptoms of anemia, and acute chronic anemia with severe aplastic anemia.

The need for transfusion therapy is based on the overall clinical history of the individual patient. Commonly cited indications include:

- Patients with hemoglobin <5 g/dL and significant signs of anemia
- Pulmonary acute chest syndrome with multisegmental disease or hypoxia
- Acute or chronic anemias with severe aplastic anemias

Correct Answer: Hemoglobin <5g/dL with clinical signs/symptoms of anemia, acute chronic anemia with severe aplastic anemia, and pulmonary acute chest syndrome with multisegmental disease or hypoxia.

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403. (3246) Q1-4069:

What is the most common postoperative complication in patients with sickle cell disease:

1) Acute chest syndrome
3) Neurological events
2) Vaso-occulsive crisis
5) None of the above
4) Renal events

Postoperative management consists of intravenous hydration, supplemental oxygen, intravenous antibiotics, chest physiotherapy, and incentive spirometry. Common complications encountered in the early postoperative period include acute chest syndrome (12%), vaso-occlusive crisis (9%), and less commonly, neurological and renal events.Correct Answer: Acute chest syndrome

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404. (3247) Q1-4070:

Intraoperatively, all patients with sickle cell disease require which of the following:

1) Cardiac rhythm monitoring
3) Active warming
2) Oxygen saturation monitoring
5) All of the above
4) Blood pressure monitoring

The most common intraoperative complications are excessive blood loss (53%), followed by hypothermia (11%). Therefore, patients require extensive monitoring of cardiac rhythm, blood pressure, temperature, and oxygen saturation. They also need active intraoperative warming, which usually consists of a combination of a warming blanket, humidifier, blood/fluid warmer, and heat lamp.Correct Answer: All of the above

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405. (3248) Q1-4071:

Which of the following postoperative thromboembolic prophylaxis options is of greatest benefit in patients with sickle cell disease:

1) Low-molecular-weight heparin
3) Warfarin
2) Low-dose heparin
5) Aspirin
4) Warfarin and foot pumps

Few published reports exist on the risk of deep vein thrombosis (DVT) in patients with sickle cell disease following orthopedic procedures. In sickle cell disease, platelets do not contribute to the pathophysiology of microvascular occlusion. However, due to splenic sequestration, patients with sickle cell disease often have thrombocytopenia. Factors associated with vaso-occlusion include the increased adhesion of the sickle cells to the endothelium and the activation of the clotting cascade with thrombin formation. Thrombin induces endothelial retraction resulting in the exposure of proadhesive extracellular components. It also upregulates endothelial expression of P-selectin, which increases binding among erythrocytes, white cells, platelets, and endothelial cells. Both of these events can facilitate thrombus formation. Following hip surgery, there is already a definable risk of DVT attributable to surgical trauma and immobility.

The goal of lower limb arthroplasty is optimal pain control with early mobilization to minimize the risk of respiratory and thromboembolic complications. Results of a meta-analysis of DVT after hip surgery suggest that patients with sickle cell disease undergoing THR are best managed with foot pumps and warfarin postoperatively to decrease the likelihood of thromboses in these patients.

Correct Answer: Warfarin and foot pumps

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406. (3249) Q1-4072:

Which of the following is the most common indication for total hip arthroplasty in patients with sickle cell disease:

1) Septic arthritis
3) Osteoarthritis
2) Avascular necrosis
5) Fracture
4) Pain crisis

The mean age of patients with sickle cell disease undergoing hip surgery is approximately 34 years, with the most frequent procedure being THR for avascular necrosis. Some patients undergo bipolar hemiarthroplasty, which can be complicated by acetabular protrusio. Because hip surgery often is more complex in patients with sickle cell disease, it often is associated with longer anesthesia time and greater blood loss. Mean blood loss in THR in patients with sickle disease is approximately 1200 mL, which is significantly greater than in patients without sickle cell disease.Correct Answer: Avascular necrosis

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407. (3250) Q1-4073:

The common genetic basis of sickle cell disease is a mutation on what chromosome:

1) Chromosome 2
3) Chromosome 11
2) Chromosome 8
5) Chromosome 14
4) Chromosome X

The common genetic basis of sickle cell disease is a mutation on chromosome 11 that results in an amino-acid substitution of valine for glutamic acid at the sixth position of the beta-globin subunit of hemoglobin that results in hemoglobin S (HbS). In the heterozygote carrier, this sickle gene mutation offers potential resistance to endemic Plasmodium falciparum malaria infections. Diagnosis of the disease is confirmed by hemoglobin electrophoresis.Correct Answer: Chromosome 11

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408. (3251) Q1-4074:

In the heterozygote carrier, the presence of this sickle gene mutation offers potential resistance to:

1) Bartonella infections
3) Pneumococcal infections
2) Clostridium infections
5) Typhoid fever
4) *Plasmodium falciparum* malaria infections

The common genetic basis of sickle cell disease is a mutation on chromosome 11 that results in an amino-acid substitution of valine for glutamic acid at the sixth position of the beta-globin subunit of hemoglobin that results in hemoglobin S (HbS). In the heterozygote carrier, this sickle gene mutation offers potential resistance to endemic Plasmodium falciparum malaria infections. Diagnosis of the disease is confirmed by hemoglobin electrophoresis.Correct Answer: *Plasmodium falciparum* malaria infections

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409. (3252) Q1-4076:

The minimally invasive surgical technique for unicondylar knee arthroplasty (UKA):

1) Everts the patella
3) Subluxes the patella
2) Resurfaces the patella
5) Violates the suprapatellar synovial pouch
4) Removes a portion of the patella

New surgical technique and instrumentation leads to less invasion of the extensor mechanism. The patella is not everted, and the suprapatellar synovial pouch remains untouched.Correct Answer: Subluxes the patella

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410. (3253) Q1-4077:

The early failures of unicondylar knee arthroplasty (UKA) were due to:

1) Patient selection
3) Surgical technique
2) Implant design
5) Patient selection, implant design, and surgical technique
4) Implant design and surgical technique

The initial high failure rate of UKA in early reports was related to improper patient selection, incorrect surgical technique, and poor implant design.Correct Answer: Patient selection, implant design, and surgical technique

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411. (3254) Q1-4078:

In unicondylar knee arthroplasty (UKA) for a varus knee:

1) The medial collateral ligament should be released
3) The medial collateral ligament should not be changed
2) The medial collateral ligament should be tightened
5) Knee alignment is corrected to 6° of valgus
4) The lateral collateral ligament should be tightened

In total knee arthroplasty (TKA), knee alignment is corrected to an anatomic 6Âº or 7Âº of valgus. In UKA, this alignment leads to excessive medial compartment tightness and overload of the opposite lateral compartment. A varus knee in UKA should remain in neutral or a few degrees of varus. In TKA, a flexion contracture can be readily corrected with additional resection of both femoral condyles. In UKA, resection of the single distal femoral condyle helps to correct the flexion contracture but also changes the distal femoral valgus. Ligament releases in UKA are not as predictable as in TKA because only one compartment is replaced in the UKA, and the forces on the opposite compartment are more difficult to balance.Correct Answer: The medial collateral ligament should not be changed

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412. (3255) Q1-4079:

In comparing high tibial osteomtomy to unicondylar knee arthroplasty (UKA):

1) Patients with high tibial osteotomy recover faster than patients with UKA.
3) High tibial osteotomy has better early results than UKA.
2) High tibial osteotomy has better 10-year results than UKA.
5) High tibial osteotomy has fewer operative complications than UKA.
4) High tibial osteotomy is better for patients who work as heavy laborers.

Although a successful UKA can eliminate pain and improve the patientâs function, heavy labor and high impact athletic activities are not encouraged. High tibial osteotomy allows a patient to perform more aggressive activities.Correct Answer: High tibial osteotomy is better for patients who work as heavy laborers.

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413. (3256) Q1-4080:

Contraindications to unicondylar knee arthroplasty (UKA) includes all of the following except:

1) Bilateral knee disease
3) Varus deformity >15°
2) Tibial subluxation
5) >10° flexion contracture
4) Inflammatory arthritis

A patientâs symptoms and physical findings should be isolated to one tibiofemoral compartment, but disease can be present in both the right and left knee as long as its just one compartment. Patient history must be thoroughly evaluated to ensure that there are no associated patellofemoral symptoms in the opposite compartment.Correct Answer: Bilateral knee disease

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414. (3257) Q1-4082:

Patellofemoral arthritis in the knee undergoing unicondylar knee arthroplasty (UKA):

1) Is an absolute contraindication
3) Does not affect the result of UKA
2) Is a relative contraindication
5) Is more symptomatic than patellar impingement
4) Is always present in UKA

Kozinn and Scott have emphasized that pain in the patellofemoral joint is a relative contraindication for UKA surgery. Degenerative changes of the patellofemoral joint also affected patient function, but the symptoms were less severe than in patients with patellar impingement. If patients report significant symptoms related to the patellofemoral joint, then UKA is contraindicated.Correct Answer: Is a relative contraindication

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415. (3258) Q1-4083:

When performing unicondylar knee arthroplasty (UKA), it is best to use polyethylene:

1) With a thickness of >10 mm
3) With a thickness of >6 mm
2) With a thickness of >8 mm
5) With a thickness of >2 mm
4) With a thickness of >4 mm

Manufacturing of polyethylene is improving, and cross-linking processes are increasing the wear properties. Most surgeons believe that it is safest to use a thickness of at least 6 mm with conventional polyethylene.Correct Answer: With a thickness of >6 mm

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416. (3259) Q1-4085:

Radiographs of the UKA over a period of years after surgery show:

1) Some progression of arthritis in the opposite compartment
3) Advanced arthritis in the opposite compartment
2) No arthritis in the opposite compartment
5) Unacceptable rate of subsidence of the tibial compartment
4) No arthritis in the patellofemoral joint

Marmor reported no significant increase in the opposite compartment. Kozinn and Scott reported failures due to progression in the opposite compartment; however, this may have been due to over correction of the knee. Berger and colleagues reported minimal change in the opposite compartment with 12-year follow-up radiographs.Correct Answer: Some progression of arthritis in the opposite compartment

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417. (3260) Q1-4086:

The minimally invasive surgical technique for unicondylar knee arthroplasty(UKA)

1) Everts the patella
3) Subluxes the patella
2) Resurfaces the patella
5) Violates the suprapatellar pouch
4) Removes a portion of the patellar

The minimally onvasive surgical technique for UKA subluxes the patella and leads to less invasion of the extensor mechanism. The patella is not everted and the suprapatellar synovial pouch remains untouched.Correct Answer: Subluxes the patella

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418. (3450) Q1-4377:

The most common organism identified in bone cultures taken from patients with sickle cell disease with osteomyelitis is:

1) *Salmonella typhimurium*
3) *Haemophilus influenzae*
2) *Staphylococcus aureus*
5) *Staphylococcus epidermis*
4) *Plasmodium falciparum*

Although Salmonella infections are highly specific to patients with sickle cell disease, the most common organism identified in bone cultures taken from patients with sickle cell disease with osteomyelitis is S aureus. Due to autoinfarction, 95% of individuals develop functional asplenia by age 5 years. This condition has been associated with a decrease in opsonin production and phagocytic activity. Thus, in infants with sickle cell disease the major cause of death is pneumococcal sepsis. It has been recommended that patients with sickle cell disease have pneumococcal vaccine administered every 3 to 5 years.Correct Answer: *Staphylococcus aureus*

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419. (3451) Q1-4378:

Second-generation cement technique implies which of the following:

1) Cement is hand-packed in the shaft of the femur.
3) Cement is hand-mixed, medullary lavage is performed, and a canal plug is used.
2) The medullary canal is rinsed out by medullary lavage.
5) External pressurization is used.
4) The canal is brushed, jet lavage is performed, and a vacuum or centrifuge machine is used.

First-generation cement technique implies that cement is hand-packed in the shaft of the femur. A cement plug is not used and a lavage of the femoral canal is not performed. Second-generation technique implies that cement is hand-mixed in a bowl, medullary lavage is performed, and a canal plug is used. Third-generation technique refers to performing high-pressure jet lavage of the femoral canal, brushing the canal of all particles, using a vacuum or centrifuge machine in the mixing procedure, and using external pressurization on a closed canal.Correct Answer: Cement is hand-mixed, medullary lavage is performed, and a canal plug is used.

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420. (3464) Q1-4399:

When comparing syringe-mixing versus bowl-mixing of bone cement, which of the following is not true:

1) Syringe-mixed bone cement has a greater density.
3) Syringe-mixed bone cement has a lesser bending modulus.
2) Syringe-mixed bone cement has a greater bending modulus.
5) Centrifuged or syringe-mixed bone cement, under vacuum conditions, is of greater strength than aerated bowl-mixed cement.
4) Syringe-mixed bone cement has a higher bending strain.

When analyzing bone cement for void content and failure in four-part bending, the results show that syringe-mixed bone cement has a greater density and a greater bending modulus and is of greater strength than aerated bowl-mixed cement.Correct Answer: Syringe-mixed bone cement has a lesser bending modulus.

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421. (3486) Q1-4426:

In an obese patient undergoing unicondylar knee arthroplasty (UKA):

1) The results are worse than in a normal weight patient.
3) The results are not predictably better or worse.
2) The results are better than in a normal weight patient.
5) Results are gender dependent.
4) The results depend on the design of the prosthesis.

The knee should have less than 15° of deformity in varus or valgus and less than 10° flexion contracture. Inflammatory or crystalline-induced arthritis, knee subluxation, gross ligamentous laxity, and obesity are relative contraindications to the procedure. Scott and colleagues found that increased body weight contributed to failure in UKA and suggested that the best candidates are less than 180 lb.Correct Answer: The results are worse than in a normal weight patient.

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422. (3489) Q1-4431:

The percentage of patients with a natural history of untreated asymptomatic osteonecrosis of the femoral head with sickle cell disease that will develop progression to pain is:

1) 10%
3) 50%
2) 30%
5) 90%
4) 70%

In a study involving 121 patients with untreated asymptomatic osteonecrosis of the femoral head, 110 of the patients went on to develop significant hip pain. Spontaneous resolution of osteonecrosis of the femoral head was not observed in asymptomatic hips.Correct Answer: 90%

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423. (3503) Q1-4454:

Which of the following statement is true regarding osteonecrosis and sickle cell disease:

1) Sickle cell patients with total hip replacement have outcomes equivalent to patients with osteonecrosis secondary to steroid use.
3) Core decompression alone is the most effective means of treatment in sickle cell patients with osteonecrosis.
2) Physical therapy alone is the most effective means of treatment in sickle cell patients with osteonecrosis.
5) Bone grafting has the best outcome for sickle cell patients.
4) Physical therapy alone is as effective as hip core decompression followed by physical therapy.

In a randomized prospective study performed by Neumayr and colleagues, physical therapy alone appeared to be as effective as hip core decompression followed by physical therapy in improving hip function and postponing the need for additional surgical intervention at a mean of 3 years after treatment.Correct Answer: Physical therapy alone is as effective as hip core decompression followed by physical therapy.

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424. (3505) Q1-4456:

In the varus knee, unicondylar knee arthroplasty (UKA) should correct the deformity:

1) 7° of anatomic valgus
3) 0°
2) 10° of anatomic valgus
5) 5° of anatomic varus
4) Permit implant positioning with 2 mm of laxity in flexion and full extension

In the medial UKA with preoperative varus, most of the reviews suggest an alignment of 0° with reference to the anatomic axis of the lower extremity or slightly less than 0° with reference to the mechanical axis. In the study by Kennedy and White on 100 UKAs, they reported that superior results were obtained when the postoperative mechanical axis of the operated limb fell in the center of the knee or slightly medial to the center.Correct Answer: 0°

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425. (3547) Q1-4542:

The most common risk factors for stress fractures is:

1) Leg length discrepancy
3) Muscle strength
2) Training regimen
5) Footwear
4) Low bone mineral density

Numerous risk factors for stress fracture exist. Most commonly, the scenario is doing âtoo much too soon.â Survey data have shown 86% of runners suffering stress fracture have had a change in duration, frequency, or intensity of training immediately prior to injury. The best independent predictors for stress fracture development in women appear to be age of menarche and calf girth.Correct Answer: Training regimen

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426. (3548) Q1-4543:

Which of the following exerts protective effects on bone:

1) Ligaments
3) Muscle-tendon unit
2) Muscle flexibility
5) Hormonal factors
4) Articular cartilage

The muscle-tendon unit exerts a protective effect on cortical bone by acting as the major shock absorber. With muscle contraction, cortical bone surface bending strains are reduced. In most weight-bearing bones it is believed that with muscle fatigue, the shock-absorbing effect is lessened and more force is transmitted directly to bone, increasing the likelihood of microdamage accumulation.Correct Answer: Muscle-tendon unit

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427. (3549) Q1-4545:

Which of the following is not associated with increased risk of stress fractures:

1) Eating disorder
3) Prolonged corticosteroid use
2) Hyperthyroidism
5) Celiac sprue
4) Hypothyroidism

Any history of frequent or prolonged corticosteroid use, hyperparathyroidism, rheumatoid arthritis, hyperthyroidism, celiac sprue, previous stress fractures or overuse injuries as well as signs or symptoms of an eating disorder also should draw oneâs attention to the possibility of a reduced bone mass.Correct Answer: Hypothyroidism

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428. (3550) Q1-4546:

Which of the following are both markers of bone formation:

1) Osteocalcin and bone specific alkaline phosphatase
3) IGF-1 and serum C-telopeptide
2) Collagen degradation products and leptin
5) IGF-1 and leptin
4) Urine N-telopeptide and serum C-telopeptide

Several metabolic hormones that influence bone formation (IGF-1, T3, leptin) as well as bone formation markers (serum Type I procollagen carboxyl and amino terminal propeptides, osteocalcin, bone specific alkaline phosphatase) and bone resorption markers (collagen degradation products, urine N-telopeptide, and serum C-telopeptide) can be followed to form an impression on the overall bone turnover status.Correct Answer: Osteocalcin and bone specific alkaline phosphatase

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429. (3551) Q1-4547:

Which of the following is not a component of the female athlete triad:

1) Disordered eating
3) Menstrual dysfunction
2) Osteopenia
5) Excessive training
4) Low bone density

The female athlete triad, first described in 1993, initially consisted of three interrelated conditions: eating disorders, amenorrhea, and osteoporosis. The definition has since been broadened to disordered eating, menstrual dysfunction, and low bone density (osteopenia or osteoporosis) to include all those at risk for the detrimental effects to bone.Correct Answer: Excessive training

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430. (3552) Q1-4548:

Which of the following is not appropriate in the conservative management of stress fractures:

1) Relative rest
3) Modification of training errors
2) Maintenance of athletic fitness
5) Gradual return to activity
4) Pain relief with nonsteroidal anti-inflammatory drugs (NSAIDs)

Literature regarding nonsteroidal anti-inflammatory drug (NSAID) use in stress fracture healing is lacking; however, there has been research into its risks associated with complete fractures and nonunion after surgery. Prostaglandins play a crucial role in bone metabolism and repair. Cyclooxygenase-2 (COX-2) products have been found to be essential to bone repair in animal studies. Animal studies have shown that NSAIDs including indomethacin, aspirin, ibuprofen, and COX-2 inhibitors cause delayed fracture healing that may or may not be reversible on cessationCorrect Answer: Pain relief with nonsteroidal anti-inflammatory drugs (NSAIDs)

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431. (3553) Q1-4549:

How much should training time and intensity be increased per week to avoid bone stress injury:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

Generally, it is best to increase training time and intensity by <10% per week to avoid bone stress injury. Particularly important to female athletes are intrinsic conditions such as disordered eating and menstrual dysfunction resulting in low bone density.Correct Answer: 10%

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432. (3554) Q1-4550:

Which of the following sites are not at increased risk for complications following stress fractures (i.e., delayed union, nonunion, or progression to complete fracture):

1) Olecranon
3) Mid tibia
2) Sesamoids of the great toe
5) Navicular
4) Radius

Delayed union and nonunion are seen in approximately 10% of all stress fractures and occur more commonly in sesamoids of the great toe, proximal and mid tibia, base of the fifth metatarsal, navicular, and olecranon.Correct Answer: Radius

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433. (3555) Q1-4551:

Which of the following stress fractures is associated with a particularly high level of morbidity:

1) Vertical patellar stress fracture
3) Lateral femoral neck
2) Second metatarsal
5) Proximal tibia
4) Fibula

Lateral- or tension-sided femoral neck fractures are most commonly associated with a high level of morbidity following completion of fracture. In fact, one study found 60% of appropriately treated displaced femoral neck fractures were still unable to return to their preinjury level of participationCorrect Answer: Lateral femoral neck

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434. (3556) Q1-4552:

Metal-on-metal articulations generate how much more wear than metal-on-polyethylene articulations:

1) Less wear
3) 10 times less wear
2) 10 times more wear
5) 10,000 times less wear
4) 10,000 times more wear

Metal-on-metal articulations generate approximately $6.7x10^{12}$ to 2.5×10^{14} particles every year, which is 13,500 times the number of particles produced from a typical metal-on-polyethylene bearing.Correct Answer: 10,000 times more wear

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435. (3557) Q1-4553:

The volumetric wear of a metal-on-metal articulation compared to polyethylene particles is:

1) Lower
3) Higher
2) Approximately the same
5) Depends on the metal involved
4) Not comparable

The actual volumetric wear of a metal-on-metal articulation is lower because of the nano-scale size of the particles (generally < 50 nm) when compared with polyethelene particles, which are rarely <0.1 µm.Correct Answer: Lower

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436. (3558) Q1-4554:

Prosthesis-derived metal wear products are found in:

1) Synovial fluid
3) Liver and spleen
2) Synovial fluid and periprosthetic tissues
5) Synovial fluid, periprosthetic tissues, lymph nodes, and liver and spleen
4) Lymph nodes

Prosthesis-derived metal wear products are found extensively within the synovial fluid and periprosthetic tissues of arthroplasty patients. At post-mortem further accumulation has been identified in the regional lymph nodes, liver and spleen. Because metal particles are very small (nano scale), the true extent of dissemination is not yet known.Correct Answer: Synovial fluid, periprosthetic tissues, lymph nodes, and liver and spleen

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437. (3559) Q1-4555:

When metal nanoparticles are taken up by cells the biological response to the metal wear particles:

1) Induces cytotoxicity
3) Stabilizes the cell membrane
2) Causes oxidative stress
5) Induces chromosomal damage, cytotoxicity, and causes oxidative stress
4) Induces chromosomal damage

The uptake of metal nanoparticles(<150 nm) by cells occurs by endocytotic processes, particularly nonspecific receptor-mediated endocytosis and pinocytosis. Larger particles (>150 nm) can stimulate phagocytosis in specialized cells such as macrophages. Once internalized, metal particles can induce cytotoxicity, chromosomal damage, and oxidative stress. The toxicity of particles is modified by passivation and particle size. These factors both influence the dissolution of metal from the surface, which may account for biological activity. Evidence of cell damage, such as irregular cell membranes and enlarged mitochondria, may be induced by the physical properties of the particles.Correct Answer: Induces chromosomal damage, cytotoxicity, and causes oxidative stress

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438. (3560) Q1-4556:

The pattern of inflammation in the periprosthetic tissue of loose metal-on-metal articulations is characterized by:

1) Perivascular infiltration of eosinophils
3) Perivascular infiltration of plasma cell
2) Perivascular infiltration of lymphocytes
5) Perivascular infiltration of lymphocytes and accumulation of plasma cells
4) Perivascular infiltration of polymorphonuclears

The pattern of inflammation in the periprosthetic tissue of loose metal-on-metal articulations is significantly different to that of metal-on-metal polyethylene articulations, and is characterized by perivascular infiltration of lymphocytes and the accumulation of plasma cells. Experimental data suggest that orthopedic metals induce immunological effects that support a cell-mediated hypersensitivity response.Correct Answer: Perivascular infiltration of lymphocytes and accumulation of plasma cells

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439. (3561) Q1-4557:

The International Agency for Research on Cancer classified Cr (VI) and Ni (II) as:

1) Non carcinogenic
3) Possibly carcinogenic
2) Carcinogenic
5) Moderately carcinogenic
4) Moderately carcinogenic

The International Agency for Research on Cancer, which publishes information on the risks posed by chemicals on the development of human cancers, has classified Cr (VI) and Ni (II) as carcinogenic, metallic Ni and soluble Co as possibly carcinogenic, and metallic Cr, Cr (III) compounds and implanted orthopedic alloys as unclassifiable.Correct Answer: Carcinogenic

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440. (3562) Q1-4558:

Which of the following metals is likely to induce developmental toxicity in pregnancy as suggested by animal studies:

1) Cr
3) Ni and V
2) Co
5) Cr, Co, NI, V and Al
4) Cr and Co

Experimental animal studies suggest that several metals, including Cr, Co, Ni, V and Al, may induce development toxicity. For example, Cr (VI) exposure in male and/or female mice either before or during gestation can affect the number of implantations and viable fetuses resulting from conception. Many metals can also induce teratogenic malformations, including Cr, Ni, and V.Correct Answer: Cr, Co, NI, V and Al

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441. (3563) Q1-4559:

The accumulation of what metal was attributed to the 1996 episode of âbeer-drinkersâ cardiomyopathy:

1) Al
3) Cr
2) Co
5) Ni
4) V

The accumulation of Co in the myocardium can induce cardiomyopathy, which was particularly evident after the 1996 episode of âbeer-drinkersâ cardiomyopathy, during which Co was used as a foam-stabilizing agent in beer.Correct Answer: Co

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442. (3564) Q1-4560:

The deposition of what metal in bone has been linked to osteomalacia, bone pain, and pathological fractures:

1) Al
3) Cr
2) Co
5) Ni
4) V

Deposition of A1 in the bone occurs as a consequence of chronic exposure and has been linked to osteomalacia, bone pain, pathological fractures, proximal myopathy, and the failure to respond to vitamin D therapy.Correct Answer: Al

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443. (3565) Q1-4561:

Which of the following metals has been documented to cause serve retinal degeneration:

1) Al
3) Ni
2) Co
5) Al, Co, and Ni
4) Al and Co

Al, Co, and Ni can cause severe retinal degeneration at high-concentrations in experimental animals.Correct Answer: Al, Co, and Ni

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444. (3566) Q1-4562:

The incidence of dermal reactions and positive skin-patch testing to Co, Ni, and Cr in patients with total joint replacement with stable prostheses is:

1) 5% above those of the general population
3) 15% above those of the general population
2) 10% above those of the general population
5) 50% above those of the general population
4) 30% above those of the general population

Metal-induced skin reactions can include contact dermatitis, urticaria, and/or vasculitis. The incidence of dermal reactions and positive skin-patch testing to Co, Ni, and Cr in patients with total joint replacement with stable and loose prostheses increases by 15% and 50% respectively, above those of the general population.Correct Answer: 15% above those of the general population

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445. (3567) Q1-4563:

The incidence of dermal reactions and positive skin-patch testing to Co, Ni, and Cr in patients with total joint replacement with unstable prostheses is:

1) 5% above those of the general population
3) 15% above those of the general population
2) 10% above those of the general population
5) 50% above those of the general population
4) 30% above those of the general population

Metal-induced skin reactions can include contact dermatitis, urticaria ,and/or vasculitis. The incidence of dermal reactions and positive skin-patch testing to Co, Ni, and Cr in patients with total joint replacement with stable and loose prostheses increases by 15% and 50% respectively, above those of the general population.Correct Answer: 50% above those of the general population

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446. (3568) Q1-4564:

Hepatocellular necrosis has been observed with high levels of _____ in the body.

1) Al
3) Cr
2) Co
5) Ni
4) V

Hepatocellular necrosis often occurs in response to high levels of metal in the body, as observed after acute ingestion of Cr (VI) in humans.Correct Answer: Cr

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447. (3569) Q1-4565:

Which metal ion concentrates in the epithelial cells of the proximal tubules and can impair renal function, induce tubular necrosis, and cause marked interstitial changes in experimental animals and humans:

1) Al
3) Cr
2) Co
5) Ni
4) V

Cr is concentrated in the epithelial cells of the proximal renal tubules and can impair renal function, induce tubular necrosis, and cause marked interstitial changes in experimental animals and humans. Indicators of tubular dysfunction have been identified in human objects exposed to Cr (VI) through occupation. Al, Ni, and Co are all rapidly excreted by the kidney, hence renal toxicity tends to require significantly larger doses.Correct Answer: Cr

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448. (3570) Q1-4566:

Severe neurological manifestations have been attributed with accumulation of what metal ion in the brain:

1) Al
3) Cr
2) Co
5) Ni
4) V

Several neurological manifestations have been attributed to Al intoxication in humans, including memory loss, jerking, ataxia, and neurofibrillary degeneration. The development of some neuropathological conditions, including amyotrophic lateral sclerosis, Parkinsonian, dementia, dialysis encephalopathy, and senile plaques of Alzheimerâs disease, may be related to the accumulation of Al in the brain.Correct Answer: Al

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449. (3637) Q1-7414:

What is the preferred imaging modality to determine the glenoid wear pattern in a patient with rheumatoid arthritis:

1) Plain radiographs
3) Magnetic resonance image
2) Fluoroscopically positioned plain radiographs
5) Computed tomography scan
4) Tomograms

A computed tomography scan provides important information in regard to the version of the glenoid, wear pattern, amount of wear, glenohumeral subluxation, as well as desired entry point.Correct Answer: Computed tomography scan

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450. (3638) Q1-7415:

What is the most common reason for revision among patients who undergo shoulder arthroplasty for rheumatoid arthritis:

1) Infection
3) Humeral component loosening
2) Instability
5) Painful glenoid arthritis
4) Glenoid component loosening

The most common reason for revision surgery among patients with rheumatoid arthritis is painful glenoid arthritis. The rate of revision for painful glenoid arthritis is higher than that for glenoid component loosening.Correct Answer: Painful glenoid arthritis

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451. (3639) Q1-7416:

What is the most frequent intraoperative complication during the course of shoulder arthroplasty for rheumatoid arthritis?

1) Pulmonary embolism
3) Deltoid tearing
2) Cervical spine instability
5) Periprosthetic humeral fracture
4) Nerve injury

Poor quality bone is one of the primary challenges when performing a shoulder arthroplasty in a patient with rheumatoid arthritis. Periprosthetic humeral fracture is the most frequent intraoperative complication in this patient population.Correct Answer: Periprosthetic humeral fracture

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452. (3640) Q1-7417:

Among patients with a stiff shoulder or severe scarring, what approach can be used to minimize potential intraoperative complications:

1) Transacromial approach
3) Superior approach
2) Posterior approach
5) Anteromedial approach
4) Direct lateral approach

The anteromedial approach is a safe and effective approach when performing shoulder arthroplasty in patients with severe stiffness and poor quality tissue.Correct Answer: Anteromedial approach

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453. (3641) Q1-7418:

In addition to routine medical clearance prior to surgery, what additional test should be considered in patients with rheumatoid arthritis:

1) Hip radiographs
3) Wrist radiographs
2) Knee radiographs
5) Cervical spine: Flexion-extension views
4) Hand radiographs

A significant incidence of cervical spine disease exists among patients with rheumatoid arthritis. Surgeons should consider obtaining cervical spine flexion-extension views to evaluate for potential instability prior to the patient undergoing anesthesia.Correct Answer: Cervical spine: Flexion-extension views

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454. (3642) Q1-7419:

The most common technical cause of dislocation after primary total hip arthroplasty (THA) is:

1) Implant failure
3) Component malposition
2) Infection
5) Neurologic dysfunction
4) Muscle weakness

Although neurologic dysfunction, soft tissue laxity, and loosening due to implant failure or infection contribute to THA instability, component malposition is the leading cause of dislocation from surgical technique.Correct Answer: Component malposition

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455. (3643) Q1-7420:

Which of the following is not a consequence of acetabular shell malposition:

1) Fibrous ingrowth
3) Increased bearing wear
2) Increased fretting wear
5) Limited range of motion
4) Impingement

Malposition leads to limited range of motion, impingement, and increased bearing and fretting wear. Fibrous ingrowth is most commonly a consequence of inadequate fixation and excessive micromotion.Correct Answer: Fibrous ingrowth

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456. (3644) Q1-7421:

Excessive anteversion of the acetabular cup may lead to:

1) Cup medialization
3) Leg length discrepancy
2) Posterior implant impingement
5) Dislocation with excessive internal rotation
4) Premature osteolysis

Excessive anteversion leads to anterior dislocation due to posterior component impingement. This most commonly occurs through extension and external rotation of the lower extremity. Excessive anteversion has little or no direct effect on medialization of the cup, leg length disparity, or premature osteolysis.Correct Answer: Posterior implant impingement

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457. (3645) Q1-7422:

Mechanical guide inaccuracy in cup placement during total hip arthroplasty occurs due to:

1) Anatomic soft tissue variance
3) Poor implant fixation
2) Displaced fracture of acetabulum
5) Pelvic positional instability
4) Excessive motion between guide and implant

With adequate exposure, compensation for soft tissue variance is accomplished. Fracture is uncommon, as is gross motion between implant and bone. Provided the guide is used correctly, there is no appreciable motion between it and the implant. Changes in pelvic and patient position, however, will render the mechanical guide inaccurate.Correct Answer: Pelvic positional instability

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458. (3646) Q1-7423:

Excessive abduction of the acetabular shell may result in all of the following except:

1) Edge loading
3) Osteolysis
2) Superior instability
5) Linear polyethylene wear
4) Superior cup migration

Edge loading, superior dislocation or subluxation, linear polyethylene wear and resultant premature osteolysis may all result from an excessively abducted cup. Superior cup migration is most commonly a consequence of a cup with low abduction.Correct Answer: Superior cup migration

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459. (3647) Q1-7424:

Longevity of traditional total hip arthroplasty in young patients is limited by:

1) Implant failure
3) Fracture
2) Infection
5) Limited range of motion
4) Osteolysis and aseptic loosening

Although implant failure, infection, and fracture occur with extended lifetime of hip implants, polyethylene wear debris and eventual aseptic loosening are the most commonly recognized limitation in the survival of total hip arthroplasty. Limited range of motion is a less common presentation for implant failure in the hip.Correct Answer: Osteolysis and aseptic loosening

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460. (3648) Q1-7425:

Advantages of metal-on-metal vs metal-on-polyethylene articulation include:

1) Metal ion generation
3) Lower infection rate
2) Capacity for large head diameter
5) Lower cost
4) Increased bearing wetability

Metal ions generated, although of unknown consequence, are not considered an advantage. Metal-on-metal bearings have not been shown to demonstrate a lower infection rate or lower cost, nor do they have increased wetability (commonly associated with ceramic bearings). The metal-on-metal implants allow larger head and cup diameter, thus providing improved range of motion with lower risk for dislocation.Correct Answer: Capacity for large head diameter

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461. (3649) Q1-7426:

Which of the following cannot be modified during hip resurfacing:

1) Cup medialization
3) Leg length
2) Femoral component angle
5) Cup angle
4) Cup size

All of the above variables can be modified during the planning and placement of hip resurfacing with the exception of leg length. Due to the anatomic reproduction of the cup center and femoral head anatomy, modifications on leg length cannot be performed with hip resurfacing.Correct Answer: Leg length

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462. (3650) Q1-7427:

The most common failure mechanism in hip resurfacing is:

1) Acetabular component loosening
3) Recurrent dislocation
2) Infection
5) Fracture
4) Femoral component loosening

Among outcome studies, the most common failure mechanism for hip resurfacing is femoral neck fracture. Dislocation, infection, and loosening have been reported at lower rates.Correct Answer: Fracture

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463. (3651) Q1-7428:

Potential contraindication for primary hip resurfacing include all of the following except:

1) Excessive femoral cyst formation
3) Previous femoral neck fracture
2) Osteoporosis with low bone density t-score
5) Osteonecrosis with femoral head collapse
4) Severe developmental hip dysplasia

Excessive cyst formation in the femoral head, documented osteoporosis, severe developmental hip dysplasia, and advanced osteonecrosis are contraindications to hip resurfacing. Previous femoral neck fracture, however, if healed, does not provide a risk for femoral neck fracture.Correct Answer: Previous femoral neck fracture

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464. (3652) Q1-7429:

Failure of first-generation cementless femoral stems is attributed to:

1) Material composition
3) Wear particle migration
2) Malrotation
5) Fracture
4) Fatigue failure

Initial stem design of cementless stems included patch porous coating. This design feature resulted in wear particle migration distally, causing inevitable aseptic loosening. The remaining options were not instrumental in cementless stem loosening.Correct Answer: Wear particle migration

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465. (3653) Q1-7430:

Evidence of cementless acetabular implant loosening is radiographically observed as:

1) Surrounding cystic lesions
3) Increased radiodensity
2) Heterotopic bone formation
5) Radiolucency surrounding the shell
4) Implant spot welds

Of the choices listed, only radiolucency provides evidence of acetabular loosening. Cystic lesions, known as osteolysis, may exist without the presence of loosening.Correct Answer: Radiolucency surrounding the shell

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466. (3654) Q1-7431:

Increased scintigraphic activity surrounding an implant may signal all of the following except:

1) Recent implantation
3) Osteolysis
2) Quiescent heterotopic bone
5) Infection
4) Loosening

Bone scan studies are sensitive, but poorly specific. The differential includes recent implantation (up to 1 year), osteolysis, loosening, fracture, and infection. Mature heterotopic ossification is generally cold on bone scan.Correct Answer: Quiescent heterotopic bone

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467. (3655) Q1-7432:

Imaging of pelvic bone loss around the acetabulum is best accomplished with:

1) Pelvic Judet views
3) Pelvic inlet view
2) Computed tomography (CT) scan
5) Pelvic outlet view
4) Cross-table lateral of affected hip

Studies have shown CT scans to be the most thorough means of assessing bone loss in the presence of osteolysis in the pelvis.Correct Answer: Computed tomography (CT) scan

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468. (3656) Q1-7433:

The ideal range of micromotion to stimulate bone ingrowth into cementless implants is:

1) Less than 20 microns
3) 200 microns to 500 microns
2) 30 microns to 150 microns
5) Greater than 900 microns
4) 600 microns to 800 microns

Ideal values of micromotion that stimulate bone ingrowth are 28 microns to 150 microns. Values greater than 150 microns are associated with fibrous ingrowth.Correct Answer: 30 microns to 150 microns

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469. (3657) Q1-7434:

Which of the following is a risk factor for the development of a postoperative periprosthetic fracture of the humerus:

1) Diabetes
3) Age
2) Female gender
5) Polyethylene-induced osteolysis
4) Diagnosis of avascular necrosis

Osteolysis, osteopenia, and aggressive cortical reaming have been reported as potential risk factors for the development of a postoperative periprosthetic fracture.Correct Answer: Polyethylene-induced osteolysis

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470. (3658) Q1-7435:

What nerve is most frequently injured at the time of a periprosthetic fracture of the humerus:

1) Median nerve
3) Radial nerve
2) Ulnar nerve
5) Axillary nerve
4) Musculocutaneous nerve

The radial nerve is the most frequently injured nerve at the time of a periprosthetic fracture. There continues to be debate as to whether the presence of a radial nerve injury constitutes a reason for revision surgery.Correct Answer: Radial nerve

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471. (3659) Q1-7436:

What is the average length of time for a periprosthetic humeral fracture to heal with operative treatment:

1) Less than 30 days
3) Between 90 and 120 days
2) Between 30 and 90 days
5) Greater than 240 days
4) Between 120 and 240 days

In a study by Kumar and colleagues, the mean time to healing among patients who underwent surgery was 278 days (range, 135 to 558 days).Correct Answer: Greater than 240 days

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472. (3660) Q1-7437:

According to the classification system of Wright and Cofield, what constitutes a type A periprosthetic humeral fracture:

1) Fracture at the tip of the prosthesis, extends proximally
3) Prosthesis tip with extension distally
2) Prosthesis tip without extension
5) Distal to the tip of prosthesis
4) Fracture present with a loose prosthesis

According to the classification, a type A fracture is one at the tip of the prosthesis and extends proximally. Type B fractures occur at the prosthesis tip without extension or with a minimal amount of proximal extension and a variable amount of distal extension. Type C fractures are distal to the tip of prosthesis.Correct Answer: Fracture at the tip of the prosthesis, extends proximally

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473. (3661) Q1-7438:

What is the preferred treatment for a type C periprosthetic fracture with a well-fixed humeral component:

1) Open reduction internal fixation with a plate
3) Strut allograft and cerclage wires
2) Long stem prosthesis
5) Long stem with a strut
4) Nonoperative treatment

In patients with a type C periprosthetic fracture (distal to the tip of the prosthesis) and a well-fixed humeral component, the injury can be treated similar to a closed humerus fracture.Correct Answer: Nonoperative treatment

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474. (3754) Q1-7535:

The approximate distance of the axillary nerve from the lateral border of the acromion is:

1) 1 cm
3) 5 cm
2) 3 cm
5) 10 cm
4) 7 cm

The axillary nerve is located approximately 5 cm from the lateral border of the acromion.

Correct Answer: 5 cm

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475. (3755) Q1-7536:

Which of the following nerves enters the coracobrachialis muscle distal to the tip of the coracoids:

1) Radial nerve
3) Median nerve
2) Ulnar nerve
5) Axillary nerve
4) Musculocutaneous nerve

The musculocutaneous nerve enters the coracobrachialis muscle 4 cm to 8 cm distal to the tip of the coracoid process.

Correct Answer: Musculocutaneous nerve

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476. (3756) Q1-7537:

Which of the following approaches is used when the deltoid is taken down off the clavicle and anterior acromion:

1) Superior approach
3) Direct approach
2) Anterosuperior approach
5) Medial approach
4) Anteromedial approach

The anteromedial approach involves taking the deltoid down off the clavicle and anterior acromion.

Correct Answer: Anteromedial approach

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477. (3757) Q1-7538:

The deltoid inserts on this surface of the clavicle:

1) Superior surface
3) Inferior surface
2) Anterior surface
4) All of the above

The origin of the deltoid on the clavicle is J-shaped and extends from the midline on the superior aspect of the clavicle around the front of the clavicle to the inferior portion of the anterior aspect of the clavicle. Full-thickness fascial flaps must be obtained when the deltoid is released from the clavicle.

Correct Answer: All of the above

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478. (3758) Q1-7539:

Which of the following is an indication for an anteromedial approach:

1) Post-traumatic arthritis with severe scarring
3) Revision shoulder arthroplasty
2) Rheumatoid arthritis
4) All of the above

The anteromedial approach facilitates shoulder arthroplasty in patients with severe scarring, distortion of anatomy, as well as patients with frail bone and soft tissue.

Correct Answer: All of the above

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479. (4066) Q1-7540:

What are the contraindications for a corrective osteotomy for a proximal humerus malunion:

1) Glenohumeral arthritis
3) Articular incongruity
2) Massive rotator cuff tear
5) All of the above
4) Avascular necrosis

Corrective osteotomy is an option for surgeons who must treat a patient with a proximal humerus malunion. This option may best be considered in a young, active patient who has no radiographic evidence of degenerative changes in the glenohumeral joint. In an older, less active patient who has evidence of degenerative joint disease, a shoulder arthroplasty may be a more suitable and definitive procedure.

Patients with proximal humerus malunions often present with complaints of pain as well as loss of function. Frequently, patients have impingement-type pain due to a malunion of the greater tuberosity with an associated decrease in the subacromial space. Some of the contraindications to a corrective osteotomy include a massive irreparable rotator cuff tear, significant degenerative changes of the articular surfaces, avascular necrosis, active infection, or nerve injury.

Correct Answer: All of the above

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480. (3759) Q1-7541:

What is the most significant factor affecting the results of shoulder arthroplasty for a malunion:

1) Placement of a glenoid component
3) Resurfacing arthroplasty of the humerus
2) Placement of a reverse shoulder arthroplasty
5) Performing a biceps tenodesis
4) Avoidance of performing a tuberosity osteotomy

Boileau and colleagues reported that the most significant factor affecting results of shoulder arthroplasty for malunion was the need for greater tuberosity osteotomy.

Correct Answer: Avoidance of performing a tuberosity osteotomy

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481. (3760) Q1-7542:

When considering arthroscopic treatment of a malunion, what is the procedure most frequently performed:

1) Biceps tenodesis
3) Arthroscopic capsular release
2) Superior labral anterior posterior (SLAP) repair
5) Tuberoplasty
4) Acromioplasty

Arthroscopic acromioplasty has been reported by Beredjiklian and colleagues. The procedure essentially increases the available subacromial space to improve impingement of the greater tuberosity against the acromion.

Correct Answer: Acromioplasty

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482. (3761) Q1-7543:

What are the complications commonly associated with tuberosity osteotomy at the time of shoulder arthroplasty for malunion:

1) Nonunion of the tuberosity
3) Malunion of the tuberosity
2) Tuberosity resorption
4) All of the above

Antuna and colleagues reported that 10 of 24 shoulders that had a greater tuberosity osteotomy had a complication related to tuberosity nonunion, malunion, or resorption.

Correct Answer: All of the above

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483. (3762) Q1-7544:

Which of the following intraoperative techniques can be used to avoid tuberosity osteotomy:

1) Placement of the stem in slight varus
3) Placement of the stem in slight valgus
2) Bending the stem to accommodate the deformity
4) All of the above

Implantation of the humeral component in slight varus or valgus to accommodate the tuberosity malunion was not associated with an increased incidence of humeral component loosening. In addition, humeral components with a modified curvature in the stem have been used with success.

Correct Answer: All of the above

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484. (3763) Q1-7545:

What are the potential benefits of performing a lesser tuberosity osteotomy:

1) Bone-to-bone healing
3) Ability to detect on radiographs disruption of the anterior repair
2) Improved glenoid exposure
4) All of the above

A lesser tuberosity osteotomy allows bone-to-bone healing as well as facilitates glenoid exposure. Moreover, disruption of the anterior repair is immediately evident on postoperative radiographs with the appearance of a displaced lesser tuberosity.

Correct Answer: All of the above

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485. (3764) Q1-7546:

What are the potential benefits of performing magnetic resonance imaging (MRI) of a shoulder arthroplasty with a suspected rotator cuff tear:

1) Assess degree of fatty atrophy
3) Evaluate the size of the tear
2) Define the location of the tear
4) All of the above

An MRI allows a surgeon to gain a greater understanding of the size of the rotator cuff tear, the specific location of the tear, and the degree of fat infiltration within the tendon.

Correct Answer: All of the above

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486. (3765) Q1-7547:

In an elderly patient with a postoperative rotator cuff tear and escape, which of the following options is most effective to create a stable shoulder arthroplasty:

1) Coracohumeral reconstruction with an Achilles tendon graft
3) Hemiarthroplasty
2) Bipolar arthroplasty
4) Reverse shoulder arthroplasty

Many patients with a rotator cuff tear following shoulder arthroplasty may develop anterior-superior escape. Once this pattern develops, it may be difficult to restore stability with attempted rotator cuff repair alone. In this setting, one may consider the use of a reverse arthroplasty, particularly if the patient is older than 70 years of age.

Correct Answer: Reverse shoulder arthroplasty

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487. (3766) Q1-7548:

What is the reported frequency of rotator cuff tear following shoulder arthroplasty:

1) Less than 1%
3) 3% to 4%
2) 1% to 2%
4) Greater than 5%

The reported frequency of postoperative rotator cuff tears following shoulder arthroplasty is 3% to 4%.

Correct Answer: 3% to 4%

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488. (3767) Q1-7549:

What are some potential benefits of performing arthroscopic compared to open acromioplasty in a patient who develops impingement syndrome following hemiarthroplasty:

1) Ability to evaluate the status of the glenoid
3) More rapid postoperative recovery
2) Capacity to address intra-articular pathology
5) All of the above
4) Less violation of the deltoid

Arthroscopic acromioplasty has been used for the treatment of impingement following shoulder arthroplasty. It has the potential benefits of less tissue disruption, more rapid recovery, as well as increased ability to address intra-articular pathology compared to an open procedure.

Correct Answer: All of the above

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489. (3867) Q1-7650:

Which medication has been identified as a risk factor for a nerve injury after shoulder arthroplasty:

1) Prednisone
3) Clopidogrel bisulfate
2) Warfarin
5) Methotrexate
4) Aspirin

Methotrexate has been identified as a risk for development of a nerve injury after shoulder arthroplasty.

Correct Answer: Methotrexate

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490. (3868) Q1-7651:

Which is the most common mechanism for nerve injury after shoulder arthroplasty:

1) Laceration
3) Contusion
2) Expanding hematoma
5) Temporary neuropraxia due to stretch
4) Tearing

The most common reason for a nerve deficit following shoulder arthroplasty is a temporary neuropraxia due to stretch.

Correct Answer: Temporary neuropraxia due to stretch

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491. (3869) Q1-7652:

Which approach has been identified as a risk factor for the development of a nerve injury with shoulder arthroplasty:

1) Transacromial
3) Superior
2) Anteromedial
5) Deltopectoral
4) Posterior

The deltopectoral approach has been identified as a risk for development of a nerve injury after shoulder arthroplasty.

Correct Answer: Deltopectoral

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492. (3870) Q1-7653:

Which nerve is most likely to have evidence of a deficit after shoulder arthroplasty:

1) Radial nerve
3) Musculocutaneous nerve
2) Ulnar nerve
5) Axillary nerve
4) Median nerve

The most common nerve that has been found to have a deficit after shoulder arthroplasty is the axillary nerve.

Correct Answer: Axillary nerve

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493. (3871) Q1-7654:

Which of the following is the reported incidence of nerve injuries following total shoulder arthroplasty:

1) Less than 1%
3) Between 2% and 4%
2) Between 1% and 2%
5) Greater than 10%
4) Between 4% and 5%

The reported incidence of nerve injuries following shoulder arthroplasty is 4.3%.

Correct Answer: Between 4% and 5%

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494. (3877) Q1-7660:

Which is the most common reason for revision surgery among patients who undergo hemiarthroplasty:

1) Humeral component loosening
3) Infection
2) Periprosthetic fracture
5) Glenoid arthritis
4) Instability

Painful glenoid arthritis represents the most common reason for revision surgery for hemiarthroplasties.

Correct Answer: Glenoid arthritis

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495. (3878) Q1-7661:

Which of the following are nonanatomic instability procedures:

1) Bristow
3) Magnuson-Stack
2) Putti-Platt
5) All of the above
4) Latarjet

Among patients who have undergone prior instability surgery, it is important to review prior operative reports to determine the specific instability procedure performed. This will facilitate safe and effective soft tissue releases and balancing at the time of shoulder arthroplasty.

Correct Answer: All of the above

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496. (3879) Q1-7662:

Which is the mean 10-year survival for shoulder arthroplasty after prior instability surgery:

1) Greater than 95%
3) Between 75% and 85%
2) Between 85% and 95%
5) Less than 65%
4) Between 65% and 75%

Overall, the survival rate for shoulder arthroplasty after prior instability surgery was only 61% at 10 years.

Correct Answer: Less than 65%

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497. (3880) Q1-7663:

Compared to shoulder arthroplasty for primary osteoarthritis, shoulder arthroplasty after prior instability surgery is associated with which of the following:

1) Lower revision rate
3) Higher revision rate
2) Similar revision rate

Research has shown that shoulder arthroplasty for postcapsulorraphy arthritis has inferior results and a higher revision rate compared to shoulder arthroplasty for osteoarthritis.

Correct Answer: Higher revision rate

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498. (3881) Q1-7664:

Which are the most common complications after shoulder arthroplasty for instability associated arthritis:

1) Instability
3) Glenoid arthritis
2) Component failure
4) All of the above

Shoulder arthroplasty for postcapsulorraphy arthritis provides pain relief and improved motion. However, shoulder arthroplasty in these young patients is associated with a high rate of unsatisfactory results and revision surgery due to glenoid arthritis, component failure, or instability.

Correct Answer: All of the above

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499. (3901) Q1-7781:

What anatomic factor has been identified as placing a patient at an increased risk for re-tearing a rotator cuff after repair:

1) Greater tuberosity foot print less than 2 cm in width
3) Increased humeral retroversion
2) Wide lateral extension of the acromion
5) Narrow bicipital groove
4) Increased inclination of the humeral neck

Zumstein and colleagues identified a wide lateral extension of the acromion as a risk factor for developing a recurrent rotator cuff tear.

Correct Answer: Wide lateral extension of the acromion

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500. (3902) Q1-7782:

What are some of the potential benefits of using ultrasound to evaluate the integrity of the rotator cuff:

1) Portable device
3) Dynamic evaluation
2) Low cost compared to magnetic resonance imaging (MRI)
5) All of the above
4) Noninvasive procedure

Ultrasound has become increasingly popular as a tool to evaluate rotator cuff tears. Some of the advantages of ultrasound include the fact that it is easily portable and less expensive than MRI. Additionally, unlike a computed tomography arthrogram, no injection is required. Another interesting aspect of ultrasound is that it allows dynamic evaluation of the rotator cuff. Several research studies have shown the promise of using ultrasound to follow the status of rotator cuff after repair.

Correct Answer: All of the above

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501. (3903) Q1-7783:

What is the reported incidence in the literature for a satisfactory outcome following open rotator cuff repair:

1) Less than 60%
3) Between 70% and 80%
2) Between 60% and 70%
5) Greater than 90%
4) Between 80% and 90%

Neer and researchers reviewed the results of 245 shoulders that underwent rotator cuff repair. In this patient series, an acromioplasty was also performed in 243/245 of the shoulders. In this large series, the authors reported an excellent or satisfactory result in 92% of the shoulders.

Correct Answer: Greater than 90%

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502. (3904) Q1-7784:

What tool has been recently shown to improve the accuracy of shoulder injections and has become increasingly popular in clinical application:

1) Ultrasound
3) Computed tomography scans
2) Bi-plane fluoroscopy
5) Fluoroscopy
4) Magnetic resonance imaging

A new treatment modality that has made a large impact on the treatment of patients with shoulder pain is ultrasound-guided injections. Ultrasound guidance allows the health care provider to more accurately place the injection. This has important therapeutic as well as diagnostic implications.

Correct Answer: Ultrasound

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503. (3905) Q1-7785:

What is the reported re-tear rate of massive rotator cuff tears at the near 10-year mark:

1) Less than 20%
3) Between 30% and 40%
2) Between 20% and 30%
5) Greater than 50%
4) Between 40% and 50%

Recently, Zumstein and researchers reviewed the outcome of twenty-seven consecutive open repairs of massive rotator cuff tears. At a mean follow-up of 3.1 years, the re-tear rate was 37%. At a mean follow-up of 9.9 years, among 23 patients who returned for evaluation, the re-tear rate had increased to 57%. Patients with an intact rotator cuff repair had a substantially better outcome according to Constant scores as well as abduction strength. The authors noted that the preoperative integrity of the tendon appeared to be protective against future muscle deterioration and risk of developing a re-tear. Additionally, the authors noted that a wide lateral extension of the acromion was identified as a previously unknown risk factor for re-tearing.

Correct Answer: Greater than 50%

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504. (3906) Q1-7786:

What pathologic finding is consistently observed with anterior instability following shoulder arthroplasty:

1) Anterior glenoid bone loss
3) Disruption of the infraspinatus/teres minor
2) Atrophy of the anterior deltoid
5) Disruption of the long head of the biceps
4) Disruption of the subscapularis

Tearing of the subscapularis is a common finding associated with anterior instability following shoulder arthroplasty.

Correct Answer: Disruption of the subscapularis

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505. (3907) Q1-7787:

What soft tissue augmentation is used in the reconstruction of the subscapularis when associated with anterior instability following shoulder arthroplasty:

1) Tendo Achilles allograft
3) Middle-third patellar tendon autograft
2) Hamstring tendons
5) Fascia lata
4) Triceps autograft

Moeckel and colleagues reported the use of tendo Achilles allograft for the treatment of anterior instability following shoulder arthroplasty in combination with attempted subscapularis repair.

Correct Answer: Tendo Achilles allograft

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506. (3908) Q1-7788:

Which of the following factors is associated with posterior instability following shoulder arthroplasty:

1) Retroverted humeral component
3) Retroverted glenoid component
2) Posterior capsular laxity
5) All of the above
4) Disruption of the posterior capsule

All of the above factors may contribute to posterior instability following shoulder arthroplasty.

Correct Answer: All of the above

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507. (3909) Q1-7789:

Which of the following strategies are used to treat posterior instability following shoulder arthroplasty:

1) Increasing the anteversion of the humeral component
3) Creating a neutral orientation for the glenoid
2) Using posterior capsular plication
5) All of the above
4) Delaying postoperative rehabilitation program

All of the above are potential treatment strategies for treating posterior instability following shoulder arthroplasty.

Correct Answer: All of the above

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508. (3910) Q1-7790:

What is the rate of recurrent instability following revision surgery for an unstable shoulder prosthesis:

1) Less than 5%
3) Between 10% and 20%
2) Between 5% and 10%
5) Greater than 30%
4) Between 20% and 30%

In the study by Sanchez and colleagues, more than 50% of the shoulders in the study remained unstable despite attempts at revision.

Correct Answer: Greater than 30%

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509. (3933) Q1-8118:

Labral and soft tissue pathology are best visualized using:

1) Standard pelvis magnetic resonance image (MRI)
3) 3D computed tomography (CT) scan
2) Plain film radiograph
5) MR arthrogram
4) Hip arthrogram

Although standard pelvis MRI has a role in visualizing soft tissues and bone, MR arthrogram best images the intra-articular structures of the hip. Hip arthrogram alone, CT, and plain film do not provide adequate soft tissue resolution.

Correct Answer: MR arthrogram

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510. (3934) Q1-8119:

Advantages of plain film radiograph in diagnosis and treatment of femoral acetabular impingement do NOT include:

1) Visualization of cam impingement lesion
3) Observation of joint space narrowing
2) Detection of labral injury
5) Assessment for pincer impingement
4) Detection of developmental dysplasia of the hip (DDH)

Plain film radiographs can successfully detect cam and pincer impingement and cartilage space narrowing, as well as allow quantified measurement of femoral head coverage. A magnetic resonance arthrogram is necessary, however, to successfully visualize labral pathology.

Correct Answer: Detection of labral injury

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511. (3935) Q1-8121:

Upon review of a plain film series for developmental dysplasia of the hip (DDH), contraindication to periacetabular osteotomy is suggested by:

1) Cup medialization
3) Center edge angle of 5Â°
2) Excessive acetabular index
5) No cartilage space maintained on abduction view
4) Anterior coverage of less than 5Â° on false profile

None of the options necessarily preclude periacetabular osteotomy as a treatment option for DDH provided that the patient wishes to proceed; however, little or no cartilage space, or poor concentric reduction of hip joint would suggest poor outcome with this procedure.

Correct Answer: No cartilage space maintained on abduction view

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512. (3936) Q1-8122:

The most valuable imaging study for assessment of radiographic leg length in patients preparing to undergo total hip arthroplasty is:

1) Anteroposterior (AP) of the hip
3) Magnetic resonance image of the pelvis
2) 3D computed tomography
5) Lauenstein lateral hip
4) AP of the pelvis

Of all the study techniques listed, only the AP of the pelvis allows radiographic comparison of hips. This imaging may prove helpful in assessment of leg-length disparity due to lower extremity inequity or pelvic obliquity.

Correct Answer: AP of the pelvis

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513. (3937) Q1-8125:

In the presence of osteolysis around the acetabular component, the most thorough means of visualizing bone loss is via:

1) Pelvic Judet views
3) Standard magnetic resonance imaging (MRI) of the pelvis
2) Cross-table lateral radiograph
5) Computed tomography (CT) of the hip
4) Bone scan

Computed tomography scan remains the most thorough means of assessing bone loss in the pelvis. MRI is relatively ineffective due to artifact scatter; cross-table lateral radiographs and bone scan are of little use; and pelvic Judet views, although helpful, are not as thorough as CT.

Correct Answer: Computed tomography (CT) of the hip

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514. (3976) Q1-8228:

Advances in cement technique include all of the following EXCEPT:

1) Retrograde canal filling
3) Canal plugging
2) Pressurization
5) Pressurized mixing
4) Canal lavage

Retrograde canal filling, canal pressurization and plugging, and lavage are all developments in cement technique. The mixing process has been enhanced by mixing under vacuum conditions, however, rather than pressure.

Correct Answer: Pressurized mixing

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515. (3977) Q1-8229:

In the Gruen classification of cement mantle, zone 4 is located:

1) Superior lateral
3) Mid lateral
2) Superior medial
5) Tip of the stem
4) Distal medial

In the classification described by Gruen, zone 4 is located at the tip of the stem; zone 1 is proximal lateral, and zone 7 proximal medial.

Correct Answer: Tip of the stem

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516. (3978) Q1-8230:

Cemented stem failure is most likely to result from:

1) Varus stem
3) Stem contact with endosteal cortex
2) Thin medial cement mantle
5) Valgus stem placement
4) Excessive mantle laterally

All of the above variables do not elevate the risk of stem failure with the exception of stem-cortical contact. This avoidable circumstance is thought to result in an excessively thin mantle and risk for cement fracture and subsequent loosening.

Correct Answer: Stem contact with endosteal cortex

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517. (3979) Q1-8231:

Initial enthusiasm of cemented femoral stems in total hip arthroplasty was tempered by:

1) Stem fracture
3) Recurrent dislocation
2) Poor survivorship in patients younger than 50 years of age
5) Fracture
4) Infection

Early outcomes were characterized by poor survivorship in the young population, a situation that corrected with subsequent polyethylene improvements and cement techniques.

Correct Answer: Poor survivorship in patients younger than 50 years of age

---

518. (3980) Q1-8232:

Variables that affect the rate at which cement polymerizes include the following EXCEPT:

1) Room temperature
3) Rate of mixing
2) Humidity
5) Inclusive agents, such as antibiotics
4) Material makeup of the mixing bowl

Temperature, humidity, mixing rate, and added agents affect the rate of polymerization. The materials with which the polymer and powder contact are not known to affect this rate.

Correct Answer: Material makeup of the mixing bowl

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519. (3997) Q1-8249:

Which is the preferred imaging modality to determine the fracture pattern in a patient with a proximal humerus nonunion:

1) Plain radiographs
3) Magnetic resonance image
2) Fluoroscopically-positioned plain radiographs
5) Computed tomography (CT) scan
4) Tomograms

A CT scan provides important information in regard to the fracture pattern, the amount of bone remaining in the humeral head, as well as information about the possibility of performing an ORIF with bone graft compared to proceeding with an arthroplasty procedure.

Correct Answer: Computed tomography (CT) scan

---

520. (3998) Q1-8250:

Which is the most common complication among patients who undergo shoulder arthroplasty for proximal humerus nonunion:

1) Infection
3) Humeral component loosening
2) Instability
5) Greater tuberosity nonunion
4) Glenoid component loosening

The most common reason for an unsatisfactory outcome after shoulder arthroplasty for a proximal humerus nonunion is a greater tuberosity nonunion.

Correct Answer: Greater tuberosity nonunion

---

521. (3999) Q1-8251:

Which organism is most frequently found in patients with an infected humeral nonunion:

1) *Escherichia coli*
3) *Propionibacterium acnes*
2) *Streptococcus*
5) None of the above
4) *Brucella*

One of the most common organisms found in an infected proximal humerus nonunion is *Propionibacterium acnes. Staphylococcus aureus* is another organism that is frequently found in patients with an infected humeral nonunion.

Correct Answer: *Propionibacterium acnes*

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522. (4000) Q1-8252:

Who would be a good candidate for shoulder arthroplasty for a proximal humerus nonunion:

1) An elderly patient
3) A patient with poor quality bone in the humeral head
2) A patient with a high fracture pattern
5) All of the above
4) A patient with glenohumeral arthritis

The ideal candidate for shoulder arthroplasty for a proximal humerus nonunion is an elderly patient with a small humeral head fragment of poor bone quality with associated glenohumeral arthritis.

Correct Answer: All of the above

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523. (4001) Q1-8253:

Who would be an ideal candidate for internal fixation and bone grafting in the setting of a proximal humerus nonunion:

1) A patient with a low fracture pattern
3) A young patient
2) A patient with minimal to no glenohumeral arthritis
5) All of the above
4) A patient with an intact rotator cuff

The ideal patient for an attempt at open reduction internal fixation is a young patient with a low fracture pattern, an intact rotator cuff, and minimal to no glenohumeral arthritis.

Correct Answer: All of the above

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524. (1) Q2-28:

Which of the following bone tumors commonly occurs in patients with closed physes between 20 and 50 years of age:

1) Osteoid osteoma
3) Solitary bone cyst
2) Chondromyxoid fibroma
5) Non-ossifying fibroma
4) Giant cell tumor

Certain bone tumors have a predilection to occur in certain age groups. Non-ossifying fibroma, chondromyxoid fibroma, solitary bone cyst, and osteoid osteoma tend to occur in young patients with open physes. In contrast, giant cell tumor of bone rarely occurs in patients with open physes. When giant cell tumor occurs in children with open physes, it tends to involve only the metaphysis.

The common tumors in children with open physes are:

Benign	**Malignant**
Osteoid osteoma	Osteosarcoma
Osteochondroma	Ewingâs tumor
Chondroblastoma	Leukemia
Solitary bone cyst	

In adults with closed physes, the common tumors are

Benign	**Malignant**
Giant cell tumor	Metastatic bone disease
Pagetâs disease	Multiple myeloma
	Lymphoma
	Primary mesenchymal tumors:
	Â Â Chondrosarcoma
	Â Â Malignant fibrous histiocytoma
	Osteosarcoma occurring in Pagetâs disease
	Â Â Postirradiation sarcoma

Correct Answer: Giant cell tumor

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525. (2) Q2-29:

Which of the following bone tumors arises exclusively in the epiphysis:

1) Osteoid osteoma
3) Giant cell tumor
2) Chondromyxoid fibroma
5) Non-ossifying fibroma
4) Chondroblastoma

Bone tumors tend to occur in certain locations within a bone. Knowing the specific location in the bone where a tumor arises is a good clue in determining the nature of a lesion. Chondroblastomas uniquely arise in the epiphysis or the apophysis of long bones. Common locations that one should remember include:

Epiphysis

- Chondroblastoma
- Clear cell chondrosarcoma

Metaphysis

- Osteoid osteoma
- Osteoblastoma
- Osteosarcoma
- Giant cell tumor
- Non-ossifying fibroma
- Chondromyxoid fibroma
- Ewingâs tumor
- Chondrosarcoma

Diaphysis

- Ewingâs tumor
- Adamantinoma
- Osteosarcoma (7% of cases occurring in long bones)

Correct Answer: Chondroblastoma

---

526. (4036) Q2-30:

Which of the following bone tumors commonly arises from the surface of the posterior cortex of the distal femur:

1) Ewingâs tumor
3) Parosteal osteosarcoma
2) Periosteal osteosarcoma
5) Periosteal chondroma
4) Giant cell tumor

Parosteal osteosarcomas usually have a distinctive radiographic appearance:

- Heavily mineralized nodular lesion on the surface of the bone
- Broad attachment to the cortex
- Lucent areas at the periphery of the lesion
- Large lesions encircling the bone

The most common location of parosteal osteosarcomas is the posterior cortex of the distal femur. When this lesion occurs in young patients, it is virtually diagnostic of parosteal osteosarcoma.

Correct Answer: Parosteal osteosarcoma

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527. (3) Q2-31:

Which of the following patterns of bone destruction suggests a benign process:

1) Permeative
3) Geographic with a sclerotic rim
2) Moth-eaten
5) Large lytic focus with ill-defined margin
4) Cortical erosion with cortical thickening

Active lesions in the intramedullary cavity of a bone tend to destroy the trabecular bone and will eventually remove the cortex and extend into the soft tissues. In contrast, non-aggressive lesions will generally remain in the intramedullary cavity and the host bone will contain the lesion by developing a rim of bone around the lesion. Lodwick described three patterns of bone destruction:

Geographic: The clinician can easily see where the lesion starts and ends due to a well-circumscribed area of bone destruction. There may be a rim of reactive bone that surrounds the lesion.

Moth-eaten: Multiple holes in the bone with some of the holes appearing to coalesce into a larger hole. This pattern of destruction is similar to how a group of moths destroy a piece of cloth.

Permeative: This pattern consists of multiple, small lytic lesions in the bone that are poorly marginated.

Moth-eaten and permeative patterns suggest a malignant lesion.

Correct Answer: Geographic with a sclerotic rim

---

528. (11) Q2-39:

The most common location of adamantinoma of bone is the:

1) Radius
3) Femur
2) Ulna
5) Fibula
4) Tibia

Adamantinomas almost exclusively occur in the tibia alone or in the tibia and fibula. Occasionally, this rare tumor occurs in the femur, radius, or ulna (very rare).

Radiographically, this lesion is based in the diaphysis; there is usually one dominant lesion with surrounding sclerosis and other smaller lesions, again with areas of sclerosis.

Correct Answer: Tibia

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529. (12) Q2-40:

The most common location of osteofibrous dysplasia is the:

1) Femur
3) Fibula
2) Tibia
5) Ulna
4) Radius

Osteofibrous dysplasia occurs exclusively in the tibia. This non-neoplastic condition may be related to adamantinoma. The lesion is usually located in the anterior cortex and there is often bowing of the tibia.

Correct Answer: Tibia

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530. (13) Q2-41:

The most common soft tissue sarcoma of the foot and ankle is:

1) Primitive neuroectodermal tumor
3) Liposarcoma
2) Malignant fibrous histiocytoma
5) Synovial sarcoma
4) Epithelioid sarcoma

Malignant melanoma is the most common soft tissue malignancy of the foot; however, synovial sarcoma is the most common soft tissue sarcoma. There may be a long duration of presence of the mass, with or without growth of the lesion. When one evaluates a patient with a small or large soft tissue mass on the foot, synovial sarcoma should be considered in the differential diagnosis.

Correct Answer: Synovial sarcoma

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531. (14) Q2-42:

The most common soft tissue sarcoma of the upper extremity is:

1) Primitive neuroectodermal tumor
3) Liposarcoma
2) Malignant fibrous histiocytoma
5) Synovial sarcoma
4) Epithelioid sarcoma

Epithelioid sarcoma is the most common soft tissue sarcoma of the upper extremity. This soft tissue sarcoma may have a deceptive presentation. The tumor occurs in young patients and often presents itself as a small, superficial mass or a deep tumor. When located in a superficial location, the lesion will also ulcerate. Even with biopsy, this lesion is confused with other processes such as rheumatoid nodules, granulomas, granuloma annulare, and others.

Correct Answer: Epithelioid sarcoma

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532. (15) Q2-44:

Which of the following describes the signal sequences on T1 and T2 weighted imaging of a soft tissue sarcoma:

1) Moderate(T1) / Low(T2)
3) High(T1) / High(T2)
2) Low(T1) / Low(T2)
5) High(T1) / Moderate(T2)
4) Low(T1) / High(T2)

Soft tissue sarcomas have a characteristic MRI appearance: Low signal on T1 weighted images and high signal on T2 weighted images.

It is important to remember the characteristic signal sequences of both normal tissues and abnormal ones:

	T1 weighted	**T2 weighted**
Fat	High	Moderate
Tendons	Low	Low
Ligaments	Low	Low
Fascial layers	Low	Low
Cortical bone	Low	Low
Muscle	Moderate	Moderate
Normal marrow	High	Moderate
Soft tissue sarcomas	Low	High
Fluid (ganglions, effusions)	Low	High
Pigmented villonodular synovitisâ	Very low	Very low

â Signal drop out (very low signal on gradient echo sequences)

Correct Answer: Low(T1) / High(T2)

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533. (16) Q2-46:

Which of the following describes the signal sequences on T1 and T2 weighted images of a ganglion cyst:

1) Moderate(T1) / Low(T2)
3) High(T1) / High(T2)
2) Low(T1) / Low(T2)
5) High(T1) / Moderate(T2)
4) Low(T1) / High(T2)

Ganglion cysts are composed of fluid under pressure, with a thin lining of cells. This fluid gives a uniformly low signal (very homogeneous) on T1 weighted images and a bright (hyperintense) signal on T2 weighted images. If the patient is given a contrast agent, such as gadolinium, the cyst fluid will not enhance, but the wall often will.

It is important to remember the appearances of common tissues on both T1 and T2 weighted images:

	T1 weighted	**T2 weighted**
Fat	High	Moderate
Tendons	Low	Low
Ligaments	Low	Low
Fascial layers	Low	Low
Cortical bone	Low	Low
Muscle	Moderate	Moderate
Normal marrow	High	Moderate
Soft tissue sarcomas	Low	High
Fluid (ganglions, effusions)	Low	High
Pigmented villonodular synovitisâ	Very low	Very low

â Signal drop out (very low signal on gradient echo sequences)

Correct Answer: Low(T1) / High(T2)

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534. (22) Q2-58:

Pigmented villonodular synovitis occurs most commonly in which of the following joints:

1) Hip
3) Shoulder
2) Knee
5) Ankle
4) Elbow

Pigmented villonodular synovitis occurs mainly in the large joints of the lower extremity. The knee is the most common location, followed by the hip and shoulder. This lesion may also occur in the ankle and other smaller joints.

Correct Answer: Knee

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535. (25) Q2-61:

To which of the following organs do soft tissue sarcomas most commonly metastasize:

1) Brain
3) Adrenals
2) Lungs
5) Kidneys
4) Other bones

Soft tissue sarcomas most commonly metastasize to the lungs. Plain chest radiographs may not reveal small lesions. Computerized tomography of the chest is the most sensitive method to detect small nodules that are 3 mm to 15 mm in diameter. Other sites of metastases include other bones and visceral organs, such as the liver, spleen, and kidneys.

Correct Answer: Lungs

536. (26) Q2-62:

A 15-year-old boy has a destructive lesion in the distal femur with soft tissue extension. Needle biopsy shows a high-grade osteosarcoma. CT scan of the chest is normal and the technetium bone scan shows involvement of only the distal femur. What is the surgical stage according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage IIA
2) Stage 2
5) Stage III
4) Stage IIB

From the data provided in the question, this lesion has the following features:

- High-grade: Stage II
- Extra-compartmental: Add suffix B
- No evidence of metastases: Patient is not Stage III

The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for malignant lesions has three different stages:

Stage	**Description**
Stage IA	Low-grade intracompartmental lesions (the tumor remains confined to the medullary cavity)
Stage IB	Low-grade extra compartmental (the tumor has penetrated the cortex and entered the soft tissues)
Stage IIA	High-grade intracompartmental (the tumor remains confined to the medullary cavity)
Stage IIB	High-grade extra compartmental (the tumor has penetrated the cortex and entered the soft tissues)
Stage III	The presence of metastases in addition to the primary lesion, such as pulmonary metastases or other bone lesions

In order to use this system, one must know the grade of the tumor:

Low-Grade (Stage I)	**High-Grade (Stage II)**
Parosteal osteosarcoma	High-grade intramedullary osteosarcoma
Well differentiated intramedullary osteosarcoma	Periosteal osteosarcoma
Grade I chondrosarcoma	High-grade surface osteosarcoma
Grade I hemangioendothelioma	Dedifferentiated chondrosarcoma
Grade I MFH	Grade 2, 3, 4 MFH
Chondrosarcoma in Ollier's disease	
Chondrosarcoma in Maffucci's syndrome	

Correct Answer: Stage IIB

537. (27) Q2-63:

A 16-year-old boy has a destructive lesion in the proximal humerus. There is soft tissue extension and the CT scan of the chest shows three 1-cm nodules in the left thorax and four 1-cm nodules in the right thorax. Needle biopsy shows high-grade intramedullary osteosarcoma. The surgical stage according to the system of the Musculoskeletal Tumor Society is:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage III
4) Stage II

From the data provided in the question, this lesion has the following features:

- High-grade lesion: Stage II
- Extra compartmental extension: Add suffix B
- Positive nodules on the CT scan denoting pulmonary metastases: Upgrade to Stage III with the systemic metastases

The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for malignant lesions has three different stages:

Stage	**Description**
Stage IA	Low-grade intracompartmental lesions (the tumor remains confined to the medullary cavity)
Stage IB	Low-grade extra compartmental (the tumor has penetrated the cortex and entered the soft tissues)
Stage IIA	High-grade intracompartmental (the tumor remains confined to the medullary cavity)
Stage IIB	High-grade extra compartmental (the tumor has penetrated the cortex and entered the soft tissues)
Stage III	The presence of metastases in addition to the primary lesion, such as pulmonary or other bone lesions

To use this system, one must know the grade of the tumor:

Low-Grade (Stage I)	**High-Grade (Stage II)**
Parosteal osteosarcoma	High-grade intramedullary osteosarcoma
Well differentiated intramedullary osteosarcoma	Periosteal osteosarcoma
Grade I chondrosarcoma	High-grade surface osteosarcoma
Grade I hemangioendothelioma	Dedifferentiated chondrosarcoma
Grade I MFH	Grade 2, 3, 4 MFH
Chondrosarcoma in Ollier's disease	
Chondrosarcoma in Maffucci's syndrome	

Correct Answer: Stage III

538. (28) Q2-64:

A 15-year-old boy has a non-ossifying fibroma of the distal femur discovered incidentally following a soccer injury. He currently has no pain. The width of the lesion is 1/3 of the width of the medullary cavity. What is the surgical stage according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

From the data provided in the question, this lesion has the following feature:

- The lesion is asymptomatic with no evidence of active growth

The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for benign lesions is divided into three groups - inactive (latent), active, and aggressive:

Stage	**Group**	**Characteristics**
Stage 1	Inactive (latent)	Refers to lesions that are not causing pain and show no evidence of active growth. Stage 1 lesions are generally treated with observation only.
Stage 2	Active	Refers to lesions that are causing pain or some form of disability. If a lesion has weakened the structure of the bone such that fracture may occur, the lesion would also be considered a Stage 2 lesion.
Stage 3	Aggressive	Refers to lesions that are large, have broken into the soft tissues, or have caused a pathologic fracture. These lesions are usually prone to local recurrence and have the potential of causing a major problem for the patient.

Correct Answer: Stage 1

539. (29) Q2-65:

A 12-year-old boy has a solitary osteochondroma arising from the medial cortex of the distal femur. The lesion is not painful, nor is it causing any disability. What surgical stage would be assigned according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

From the data provided in the question, this lesion has the following feature:

- This lesion is not causing any pain or disability. There is no risk of fracture or other major problem. Accordingly, the lesion is not active and would be a Stage 1 lesion.

The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for benign lesions is divided into three groups - inactive (latent), active, and aggressive:

Stage	**Group**	**Characteristics**
Stage 1	Inactive (latent)	Refers to lesions which are not causing pain and show no evidence of active growth. Stage 1 lesions are generally treated with observation only.
Stage 2	Active	Refers to lesions which are causing pain or some form of disability. If a lesion has weakened the structure of the bone such that fracture may occur, the lesion would also be considered a Stage 2 lesion.
Stage 3	Aggressive	Refers to lesions which are large, have broken into the soft tissues, or have caused a pathologic fracture. These lesions are usually prone to local recurrence and have the potential of causing a major problem for the patient.

Correct Answer: Stage 1

540. (30) Q2-66:

A 25-year-old man has a destructive lesion in the medial femoral condyle that extends to the articular surface. Open biopsy shows a giant cell tumor. There is no evidence of pathologic fracture or major soft tissue extension. What surgical stage would be assigned according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

The data in the question's stem provides the following information:

- The lesion is a giant cell tumor. These lesions behave very aggressively and grow to a large size. They can cause pathologic fracture and are prone to local recurrence. This would be a Stage 2 lesion because there is no soft tissue extension, fracture of the joint, etc.

The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for benign lesions is divided into three groups: Inactive (latent), active, and aggressive:

Stage	**Group**	**Characteristics**
Stage 1	Inactive (latent)	Refers to lesions which are not causing pain and show no evidence of active growth. Stage 1 lesions are generally treated with observation only.
Stage 2	Active	Refers to lesions which are causing pain or some form of disability. If a lesion has weakened the structure of the bone such that fracture may occur, the lesion would also be considered a Stage 2 lesion.
Stage 3	Aggressive	Refers to lesions which are large, have broken into the soft tissues, or have caused a pathologic fracture. These lesions are usually prone to local recurrence and have the potential of causing a major problem for the patient.

Correct Answer: Stage 2

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541. (33) Q2-70:

Which of the following processes may produce cystic bone erosions in the cortex on both sides of a joint:

1) Septic arthritis
3) Pigmented villonodular synovitis
2) Synovial chondromatosis
5) Hemochromatosis
4) Ochronosis

Pigmented villonodular synovitis is a synovial proliferative disorder characterized by atraumatic recurrent effusions and cystic erosions of the periarticular bone surfaces. The synovial tissue becomes hypertrophic and can cause large erosions on both sides of the joint. These erosions most commonly occur in the hip joint because of the tight capsule and the limited amount of space for extension of the disease. Conversely, in the knee, there is room for expansion and these erosions occur late in the disease.

Correct Answer: Pigmented villonodular synovitis

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542. (35) Q2-72:

Which of the following lesions characteristically has low signal intensity on both T1- and T2- weighted images and signal drop out (very low signal) on gradient echo sequences:

1) Septic arthritis
3) Synovial chondromatosis
2) Rheumatoid arthritis
5) Pigmented villonodular synovitis
4) Osteoarthritis

Within the hypertrophic synovial lining of pigmented villonodular synovitis, there is prominent hemosiderin deposition. The iron in the hemosiderin produces very low signal on both T1- and T2- weighted images. On gradient echo sequences, there is almost total loss of signal, or signal drop out (very low; black on the MRI scan).

Correct Answer: Pigmented villonodular synovitis

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543. (51) Q2-88:

In the adult, the notochord forms which of the following structures:

1) Vertebral body
3) Vertebral lamina
2) Vertebral pedicles
5) Nucleus pulposus of the intervertebral discs
4) Vertebral spinous processes

The notochord is an axial structure that forms completely in the 10-mm to 11-mm embryo. The notochord undergoes gradual involution and fragmentation by the ossification centers of the spine. In adults, the notochord forms the nucleus pulposus.

Correct Answer: Nucleus pulposus of the intervertebral discs

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544. (53) Q2-90:

The most common location of a chordoma is:

1) Cervical vertebra
3) Lumbar vertebra
2) Thoracic vertebra
5) Spheno-occipital region
4) Sacrococcygeal region

Over 50% of the time, chordomas commonly occur in the sacrococcygeal region. Cervical, thoracic, and lumbar vertebral chordomas account for approximately 10% of chordomas. The remaining chordomas occur in the spheno-occipital region.

Correct Answer: Sacrococcygeal region

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545. (57) Q2-94:

When analyzing the load elongation curve of a ligament, which of the following would be used to calculate the stiffness of the ligament:

1) Toe region slope
3) Ultimate load
2) Linear region slope
5) Ultimate elongation
4) Energy absorbed

One can determine the stiffness of a ligament, or other soft tissue, by calculating the slope in the linear region as a load is applied. When the load is initially applied, uncoiling of the collagen will occur. This region is called the 'toe region.'

The other possible answers describe different properties:

Ultimate load: The load at which the ligament fails

Ultimate elongation: The maximum length of the ligament before the structure fails

Correct Answer: Linear region slope

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546. (58) Q2-95:

At higher rates of loading, the failure pattern of a ligament will tend to occur at:

1) Proximal insertion site
3) Equally at the proximal and distal insertion sites
2) Distal insertion site
5) Failure patterns have no relationship to site of failure
4) Mid-substance

The rate of loading has a significant effect on the injury pattern of a ligament. With high strain rates, the strength and tensile modulus of ligament will be increased. The ligament will tend to fail in the mid-substance rather than the insertion sites.

At slow rates of loading, the ligament will tend to fail at the insertion site.

Correct Answer: Mid-substance

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547. (60) Q2-97:

The determination of the slope of the linear portion of the stress-strain curve of a ligament will equate to which of the following properties of a ligament:

1) Tensile strength
3) Modulus
2) Ultimate strain
5) Ultimate load
4) Energy absorption

The slope of the linear portion of the stress strain curve corresponds to the modulus of a material. The modulus of elasticity describes how easy or hard it is to deform a material. In the linear portion of the curve, there will be an exact amount of deformation for each unit of stress applied to the material.

Correct Answer: Modulus

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548. (67) Q2-107:

Ligaments have several important properties. Which of the following proteins stores energy as a ligament lengthens and returns the ligament to its original length after the load is removed:

1) Type I collagen
3) Aggregan
2) Type III collagen
5) Platelet derived growth factor
4) Elastin

The protein elastin is an important component of ligaments. As the ligament increases in length, elastin stores energy and returns the ligament to its original length.

Correct Answer: Elastin

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549. (68) Q2-108:

The major biochemical component of a ligament is:

1) Water
3) Proteoglycan
2) Collagen
5) Link protein
4) Elastin

Approximately 60% to 80% of a ligament is composed of water. Collagen is 70% to 80% of the dry weight of a ligament (90% Type I and smaller amounts of Type III). Other components, in lesser amount, include proteoglycans and elastin.

Correct Answer: Water

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550. (69) Q2-109:

Which of the following cells is responsible for maintaining the extracellular matrix of a ligament:

1) Chondrocyte
3) Fibroblast
2) Osteoblast
5) Synovial lining cells
4) Histiocyte

Fibroblasts are the cells that are responsible for maintaining the extracellular matrix of ligaments. Ligaments have a low cellularity. Matrix synthesis is affected by growth factors such as transforming growth factor-beta (TGF-B) and epidermal growth factor (EGF).

Correct Answer: Fibroblast

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551. (70) Q2-110:

Which of the following statements concerning the medial and lateral menisci is correct:

1) The medial meniscus is more mobile than the lateral meniscus
3) The menisci transmit 50% of the joint forces with the knee in extension
2) The posterior horn of the lateral meniscus is the most mobile
5) The menisci transmit 50% of the joint forces with the knee in flexion
4) The lateral meniscus is important to restrain anterior tibial translation

The menisci have an important function in load transmission, shock absorption, stability, and articular cartilage nutrition.

One should remember the following facts concerning the menisci:

Vascularity
Peripheral 30% of the medial meniscus is vascular.
Peripheral 25% of the lateral meniscus is vascular.

Mobility
The lateral meniscus is more mobile than the medial meniscus.
The anterior portion of the lateral meniscus is the most mobile.

Load transmission
Fifty percent of the joint forces are transmitted through the menisci in knee extension.
Ninety percent of the joint forces are transmitted through the menisci in knee flexion.

The meniscal stiffness increases with higher deformation rates (secondary to the viscoelastic properties of the fibrocartilage).

Stability
The medial meniscus provides a very important secondary restraint to anterior translation of the tibia.

Correct Answer: The menisci transmit 50% of the joint forces with the knee in extension

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552. (71) Q2-115:

In regard to the vascularity of the menisci, which of the following statements are correct:

1) The capillary plexus penetrates the peripheral 30% of the medial meniscus.
3) The capillary plexus penetrates the peripheral 70% of the medial meniscus.
2) The capillary plexus penetrates the peripheral 50% of the medial meniscus.
5) The entire width of the medial meniscus has excellent vascularity.
4) The capillary plexus penetrates the peripheral 90% of the medial meniscus.

The periphery of the medial and lateral menisci obtain their blood supply from a peri-meniscal capillary plexus from the inferior and superior geniculate arteries. This capillary plexus extends from the periphery to:

- 30% of the medial meniscus
- 25% of the lateral meniscus

The inner 70% to 75% of the menisci contain no blood vessels (avascular) and derive their nutrients from the synovial fluid.

Correct Answer: The capillary plexus penetrates the peripheral 30% of the medial meniscus.

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553. (72) Q2-116:

Meniscal fibrocartilage is principally composed of which of the following types of collagen:

1) Type I
3) Type VI
2) Type II
5) Type X
4) Type IX

The meniscus is composed of a complex, 3 dimensional interlacing network of collagen fibers, proteoglycan, glycoproteins, and interspersed cells of fibrochondrocyte. The meniscal extracellular matrix is composed primarily of Type I collagen fibers that are oriented circumferentially to resist tension.

Correct Answer: Type I

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554. (73) Q2-117:

Bone bruises, or occult osteochondral injury, occur in up to 80% of patients with an anterior cruciate ligament rupture. The most common location of this articular injury is:

1) Medial femoral condyle
3) Medial patellar facet
2) Medial tibial plateau
5) Lateral patellar facet
4) Lateral femoral condyle

Bone bruises, or occult osteochondral injury, occur in up to 80% of patients following an anterior cruciate ligament injury. *The most common locations are the lateral femoral condyle and the lateral tibial plateau.* These injuries damage not only the subchondral bone, but the articular cartilage, as well.

Correct Answer: Lateral femoral condyle

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555. (74) Q2-118:

Which of the following occurs when a joint is immobilized:

1) Slow decrease in collagen concentration
3) Slow decrease in proteoglycan concentration
2) Rapid decrease in collagen concentration
5) No change in either collagen or proteoglycan concentration
4) Rapid decrease in proteoglycan concentration

Motion is essential for normal articular cartilage function. Many changes occur in the articular cartilage, ligaments, capsules, and bone within a joint when it is immobilized.

There is a rapid loss of proteoglycan when a joint becomes immobilized. This loss of proteoglycan results in an increase of deformation and fluid flux when compressive loads are applied to the joint. The collagen content of the cartilage does not change and the tensile properties are maintained.

The changes are reversible and the recovery depends upon how long the joint is immobilized.

Correct Answer: Rapid decrease in proteoglycan concentration

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556. (75) Q2-119:

Articular cartilage exhibits viscoelastic behavior (time dependent behavior). When a constant load is applied, the deformation of the articular cartilage will increase. This process is called:

1) Relaxation
3) Stretching
2) Creep
5) Fretting
4) Corrosion

Articular cartilage exhibits viscoelastic behavior (time dependent). If one applies a constant load, the deformation will increase with time. This process is called creep.

Correct Answer: Creep

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557. (76) Q2-120:

Articular cartilage is composed of 4 zones. The chondrocytes of which of the following zones produce a high concentration of collagen and a low concentration of proteoglycan:

1) Superficial tangential zone
3) Deep zone
2) Middle zone
5) Tidemark zone
4) Calcified zone

The 4 articular cartilage layers have different functions and properties: superficial tangential zone, middle zone, deep zone, and calcified zone. The chondrocytes in the superficial tangential zone produce high concentrations of collagen and low concentrations of proteoglycan.

The functions of each of the zones is as follows:

Zone	Function
Superficial tangential zone	Parallel arrangement of the collagen fibrils provides the greatest tensile stiffness; chondrocytes produce high concentrations of collagen and low amounts of proteoglycan
Middle zone	Has properties intermediate between the superficial tangential zone and deep zone
Deep (radial) zone	Has the largest collagen fibrils and the highest concentration of proteoglycans, and lowest amount of water
Calcified zone	Cells have a small volume and are surrounded by calcified cartilage

Correct Answer: Superficial tangential zone

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558. (77) Q2-121:

Which of the following types of collagen is the most common type in articular cartilage:

1) Type I
3) Type IV
2) Type II
5) Type X
4) Type IX

Type II collagen is the predominant type in articular cartilage (95%). There are a number of other collagens in smaller amounts (Types IV, VI, IX, X, and XI).

Type VI: Assists with matrix attachment

Types IX, XI: May help form and stabilize the collagen fibrils formed from Type II collagen

Correct Answer: Type II

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559. (109) Q2-154:

A 12-year-old boy has multiple exostoses (osteochondromas). What is the most likely pattern of inheritance in this condition:

1) Autosomal recessive
3) X-linked recessive
2) Autosomal dominant
5) Almost always a spontaneous mutation
4) X-linked dominant

Multiple exostoses is transmitted in an autosomal dominant pattern. This condition is transmitted by both sexes with incomplete penetrance in females. This condition is more common in males.

Correct Answer: Autosomal dominant

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560. (114) Q2-159:

Which of the following describes the microscopic features of a bone island:

1) Interlacing network of bone trabeculae in a loose, vascular, stromal connective tissue
3) Scattered giant cells in a mononuclear cell background with chicken-wire calcification
2) Compact cortical bone
5) Prominent mature bone formation and low-grade malignant spindle cell tumor
4) Pleomorphic spindle cells with osteoid production

Bone islands are microscopically composed of lamellar compact bone identical to the cortical bone.

The other possible answers describe specific lesions:

Chondroblastoma:	Scattered giant cells in a mononuclear cell background with chicken-wire calcification
Osteosarcoma:	Pleomorphic spindle cells with osteoid production
Parosteal osteosarcoma:	Prominent mature bone formation and low-grade malignant spindle cell tumor
Osteoblastoma:	Interlacing network of bone trabeculae in a loose, vascular, stromal connective tissue

Correct Answer: Compact cortical bone

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561. (131) Q2-176:

Which of the following lesions would display a low to moderate signal on T1 weighted images and high signal on T2 weighted images:

1) Lipomas
3) Cortical bone
2) Subcutaneous fat
5) Tendons
4) Malignant fibrous histiocytoma

All soft tissue sarcomas have the same signal sequence - low on T1 weighted images and high on T2 weighted images.

It is important to remember the appearances of common tissues on both T1 and T2 weighted images:

Â	**T1 weighted**	**T2 weighted**
Fat	High	Moderate
Tendons	Low	Low
Ligaments	Low	Low
Fascial layers	Low	Low
Cortical bone	Low	Low
Muscle	Moderate	Moderate
Normal marrow	High	Moderate
Soft tissue sarcomas	Low	High
Fluid (ganglions, effusions)	Low	High
Pigmented villonodular synovitis*	Very low	Very low

Signal drop out (very low signal on gradient echo sequences)

Correct Answer: Malignant fibrous histiocytoma

562. (132) Q2-177:

Which of the following tissues is low signal on both T1 and T2 weighted images:

1) Subcutaneous fat
3) Muscle
2) Joint fluid
5) Tendons
4) Soft tissue sarcomas

Tissues that are principally composed of collagen and fibroblasts are low signal on both T1 and T2 weighted sequences include tendons, ligaments, and fascial layers.

It is important to remember the appearances of common tissues on both T1 and T2 weighted images:

Â	**T1 weighted**	**T2 weighted**
Fat	High	Moderate
Tendons	Low	Low
Ligaments	Low	Low
Fascial layers	Low	Low
Cortical bone	Low	Low
Muscle	Moderate	Moderate
Normal marrow	High	Moderate
Soft tissue sarcomas	Low	High
Fluid (ganglions, effusions)	Low	High
Pigmented villonodular synovitis*	Very low	Very low

Signal drop out (very low signal on gradient echo sequences)

Correct Answer: Tendons

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563. (140) Q2-185:

Which of the following describes the radiographic features of a bone island:

1) Ovoid, compact, heavily mineralized intramedullary lesion with thorny spicules
3) Surface lesion with spiculated bone formation
2) Large, nodular, heavily mineralized lesion on the surface of the bone
5) Cortically based lytic metaphyseal lesion with a sclerotic border
4) Well-demarcated nidus surrounded by a distinct zone of sclerosis

Bone islands are also referred to as enostosis. They are usually solitary and composed of dense, compact bone within the medullary cavity. Patients are often asymptomatic and the bone island is discovered as an incidental finding.

There are three features that may lead to confusion:

- The lesion may be as large as 3 cm to 5 cm.
- The bone scan may show mild activity within the lesion.
- Bone islands may grow slowly (approximately 1 mm per year).

The other possible answers describe the radiographic features of other lesions:

Osteoid osteoma: Well-demarcated nidus surrounded by a distinct zone of sclerosis
Parosteal osteosarcoma: Large, nodular, heavily mineralized lesion on the surface of the bone
Periosteal osteosarcoma: Surface lesion with spiculated bone formation
Non-ossifying fibroma: Cortically based lytic metaphyseal lesion with a sclerotic border

Correct Answer: Ovoid, compact, heavily mineralized intramedullary lesion with thorny spicules

564. (483) Q2-669:

Which of the following statements is *not* true of the meniscus:

1) Only the peripheral 25% to 30% of the meniscus has a vascular supply.
3) Fifty percent of the compressive load of the knee is transmitted through the meniscus when the knee is extended.
2) The medial meniscus functions as a secondary restraint to anterior tibial translation.
5) The lateral meniscus is semicircular in shape.
4) Meniscal fibrochondrocytes have the ability to proliferate and synthesize matrix.

One should remember these features of the meniscus:

1. Only the peripheral 25% to 30% of the meniscus has a vascular supply.

2. The medial meniscus functions as a secondary restraint to anterior tibial translation (when the anterior cruciate ligament is cut).

3. Fifty percent of the compressive load of the knee is transmitted through the meniscus when the knee is extended.

4. Eighty-five percent of the compressive load of the knee is borne by the menisci when the knee is in 90Â° of flexion.

5. Meniscal fibrochondrocytes have the ability to proliferate and synthesize matrix.

6. The medial meniscus is semicircular in shape; the lateral meniscus is circular in shape.

Correct Answer: The lateral meniscus is semicircular in shape.

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565. (484) Q2-670:

Which of the following collagen macromolecules found in articular cartilage confers the major amount of tensile strength and resistance to shear stress:

1) Type X collagen
3) Type IX collagen
2) Type II collagen
5) Type VI collagen
4) Type XI collagen

Type II collagen is the major collagen moiety found in articular cartilage. As such it confers the major amount of tensile strength and resistance to shear stress. Articular cartilage is a highly ordered structure with a flattened layer of chondrocytes at the surface and a tangential arrangement of surface collagen. Progressing into the transitional zone the collagen fibrils assume a random orientation. In the radial zone the fibrils become oriented perpendicular to the joint surface and interface with the subchondral bone.Correct Answer: Type II collagen

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566. (485) Q2-673:

Which of the following statements is true:

1) Cortical bone has a larger surface area than cancellous bone.
3) Cortical bone has higher metabolic activity than cancellous bone.
2) Cortical bone has a higher density than cancellous bone.
5) Cortical bone has a higher porosity than trabecular bone.
4) Cortical bone remodels more rapidly than cancellous bone.

Cortical bone is denser, less porous, and stiffer and stronger than cancellous bone. Cortical bone has less surface area, a slower metabolic rate, and remodels slower than cancellous bone.Correct Answer: Cortical bone has a higher density than cancellous bone.

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567. (486) Q2-674:

Which of the following statements is *not* true regarding vitamin D metabolism:

1) Vitamim D is transformed into 25 hydroxy vitamin D in the liver.
3) 1,25 dihydroxy vitamin D is produced in the liver as a result of parathyroid hormone stimulation.
2) Vitamin D is synthesized initially from 7 dehydrocholesterol in the skin.
5) 1,25 dihydroxy vitamin D increases calcium absorption across the gut wall.
4) 25 hydroxy vitamin D has a longer half life than 1,25 dihydroxy vitamin D.

1,25 dihydroxy vitamin D is produced in the kidney, not the liver. Vitamin D is transformed into 25 hydroxy vitamin D in the liver. This metabolite has an approximate half-life of 3 days. Via parathyroid hormone stimulation, this metabolite is hydroxylated again in the kidney to form the active metabolite of vitamin D, namely 1,25 dihydroxy vitamin D. This form has a short half-life of approximately 8 hours.Correct Answer: 1,25 dihydroxy vitamin D is produced in the liver as a result of parathyroid hormone stimulation.

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568. (487) Q2-675:

Which of the following clinical findings *is not* associated with hyperparathyroidism:

1) Bone pain
3) Pathologic fractures
2) Brown tumors
5) Increased erythrocyte sedimentation rate and anemia
4) Renal stones

Features of hyperparathyroidism include bone pain, Brown tumors, pathologic fractures, and kidney stones. Hypercalcemia and a low or normal phosphate level are also present. The parathyroid levels are high in patients with hyperparathyroidism.

An increased sedimentation rate and anemia are associated with multiple myeloma.

Correct Answer: Increased erythrocyte sedimentation rate and anemia

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569. (488) Q2-677:

During fracture repair systemic as well as local factors come into play. Which of the following is considered a systemic factor in fracture healing:

1) Degree of vascular injury
3) Age
2) Degree of bone loss
5) Degree of immobilization
4) Type of bone affected

The degree of vascular injury is considered a local factor in fracture healing. Other such factors include degree of local trauma, type of bone affected, degree of bone loss, degree of immoblization, infection and local pathologic conditions. Systemic factors include age of the patient, hormone function, functional activity, nerve function and nutritional state.Correct Answer: Age

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570. (489) Q2-678:

Linear elastic theory is used as model for real material behavior. All of the following are fundamental assumptions of this theory except:

1) Stress and strain are not proportional to each other.
3) The material is insensitive to the rate of load application.
2) Srain is reversible when the stress is removed.
5) Strain is dimensionless.
4) The proportionality constant is called elastic modulus.

One of the fundamental assumptions of linear elastic theory is that stress and strain are proportional to each other. The proportionality constant expressed by these two entities is the material's elastic modulus. Stress is the internal reaction of a material to an externally applied force distributed over the cross-section of the material. Strain is the internal deformations of a material in response to an applied stress.Correct Answer: Stress and strain are not proportional to each other.

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571. (490) Q2-679:

Enchondral ossification is responsible for mineralization in all of the following conditions *except*:

1) Callus formation during fracture healing
3) Cartilage degeneration in osteoarthritis
2) Heterotopic bone formation
5) Perichondrial bone formation
4) Embryonic long bone development

Enchondral bone formation or ossification is bone formation on a cartilage module. Enchondral bone formation occurs in each of the following scenarios: embryonic long bone development, epiphyseal secondary center of ossification formation, callus formation during fracture healing, degenerating cartilage of osteoarthritis, calcifying cartilage tumors, and bone formed with use of demineralized bone matrix.

Intramembranous bone formation includes: flat bone development (pelvis, clavicle, and skull bones), bone formation during distraction osteogenesis, and perichondrial bone formation.

Correct Answer: Perichondrial bone formation

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572. (491) Q2-680:

During chondrocyte maturation at the growth plate, an orderly sequence of morphologic and biochemical changes occur. Which of the following statements regarding these changes is false:

1) Cells from the proliferating and upper hypertrophied zones are metabolically aerobically active and accumulate intracellular lipid and glycogen.
3) During hypertrophy of chondrocytes, the major proteoglycan produced is in the form of macromolecular complexes composed of aggrecan monomers bound noncovalently by a link glycoprotein to a hyaluronic acid backbone filament.
2) Proliferating chondrocytes in the upper growth plate contribute to most of the increase in long bone length.
5) Indian hedgehog and PTHrP form a negative feedback loop.
4) Type X collagen is produced in abundant amounts during endochondral ossification in the zone of provisional calcification.

Proliferation of chondrocytes in the upper growth plate does contribute somewhat to longitudinal growth. However, it is the process of cell hypertrophy that contributes most to increases in long bone length.Correct Answer: Proliferating chondrocytes in the upper growth plate contribute to most of the increase in long bone length.

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573. (492) Q2-681:

Which of the following skeletal dysplasias is a result of a mutation in FGF receptor-3:

1) Multiple exostoses
3) Achondroplasia
2) Multiple epiphyseal dysplasia
5) Schmid metaphysial dysplasia
4) Pseudoachondroplasia

A mutation in the fibroblast growth factor (FGF) receptor-3, leads to achondroplastic dwarfism.

The other answers have corresponding genetic defects:

Multiple epiphyseal dysplasia â Cartilage oligomeric matrix protein (COMP) of type IX collagen (COL9A2)

Pseudoachondroplasia â COMP

Schmid metaphyseal dysplasia â Type X collagen

Multiple hereditary exostoses â EXT1 and EXT2 genes

Correct Answer: Achondroplasia

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574. (493) Q2-683:

Which of the following wear mechanisms is the worst possible situation:

1) Adhesive wear
3) Third body
2) Fatigue
5) Fretting
4) Corrosive wear

A third body or particle becomes trapped between the two surfaces or materials in contact. The particle often scratches the bearing surface and results in rapid generation of wear products and further degradation of the bearing surface.Correct Answer: Third body

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575. (494) Q2-685:

Which of the following statements inaccurately describes human bone as a biomaterial:

1) Bone is isotropic.
3) Bone's strength and elastic modulus are approximately proportional to the square of its density.
2) Bone is viscoelastic.
5) Bone remodels its structure to maintain overall resistance to loading while the material itself weakens.
4) Bone is a composite.

Bone is anisotropic as the properties of the material vary with the direction of loading. This is true of most biologic materials and thus makes them difficult, if not impossible, to fully categorize.Correct Answer: Bone is isotropic.

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576. (495) Q2-687:

All of the following are true regarding abrasion chondroplasty *except:*

1) The subchondral bone plate is penetrated, allowing the subjacent bone marrow communication with the synovial fluid compartment.
3) Incomplete integration of the fibrocartilaginous matrix with the adjacent normal cartilage matrix may occur impairing the tissue's resistance to shear stress.
2) The organized collagen fibril orientation of normal articular cartilage is usually achieved in over 70% of cases.
5) Patients must be nonweight bearing for 8-12 weeks after chondroplasty.
4) The procedure depends on the ability of mesenchymal stem cells located in the subchondral bone marrow to differentiate into fibrocartilaginous tissue.

This statement is false. The organized collagen fibril orientation of normal articular cartilage, with tangentially oriented fibrils at the surface layer and radially oriented fibrils in the deep layer, never develops after the abrasion chondroplasty.Correct Answer: The organized collagen fibril orientation of normal articular cartilage is usually achieved in over 70% of cases.

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577. (496) Q2-689:

Which of the following techniques used to repair articular surface defects does *not* involve the use of mesenchymal stem cells:

1) Abrasion chondroplasty
3) Autologous chondrocyte transplantation
2) Perichondral transplants
5) Realignment osteotomy and periochondral transplant
4) Mesenchymal stem cell transplantation

In this technique, a small amount of cartilage is harvested arthroscopically from a non-weight bearing articular surface and the chondrocytes isolated by collagenase digestion. The isolated cells are then expanded in tissue culture and suspended in a collagen gel carrier. The resultant chondrocyte population is then reimplanted in a second procedure under a periosteal flap used to cover the articular cartilage defect.Correct Answer: Autologous chondrocyte transplantation

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578. (497) Q2-692:

Which of the following statements regarding the healing potential of the anterior cruciate ligament (ACL) and medical collateral ligament (MCL) is *false:*

1) MCL fibril diameters are larger and more densely packed than ACL fibrils.
3) MCL fibroblasts proliferate less rapidly than ACL fibroblasts.
2) MCL cells are more spindle shaped with cytoplasmic processes which are in contact with collagen, while ACL cells are more oval shaped and have ground substance between the cell and collagen fibrils.
5) Healing MCL has higher mRNA for pro-collagen expression than healing ACL.
4) MCL fibroblasts have increased expression of integrins on the cell surface as compared minimal integrin expression on healing ACL cells.

This statement is false. MCL fibroblasts proliferate more rapidly than ACL fibroblasts and respond differently to growth factors.Correct Answer: MCL fibroblasts proliferate less rapidly than ACL fibroblasts.

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579. (498) Q2-694:

Of the four phases of fracture repair when fixation of any variety is used, which phase occurs rapidly and crosses gaps:

1) Primary response
3) Intramedullary callus formation
2) Extramedullary callus formation
5) Intramedullary callus and primary osteonal response
4) Primary osteonal response

The extramedullary callus formed in a fixed fracture develops rapidly, requires motion, crosses gaps and depends on soft tissue viability. Immobilization inhibits this process.Correct Answer: Extramedullary callus formation

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580. (499) Q2-696:

Which of the following cell type-cell function pairings is *false*:

1) Pre-osteoblasts â stem cell for osteoblasts
3) Ostecytes â maintain mineral homeostatsis
2) Osteoblasts â synthesize organic matrix
5) Osteoblasts â receptors for PTH
4) Osteoclasts â synthesize organic matrix

Osteoclasts resorb bone by attaching to the bone surface, releasing enzymes, and dissolve the organic mineral phases of bone. Osteoclasts do not have hormone receptors.Correct Answer: Osteoclasts â synthesize organic matrix

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581. (500) Q2-697:

The following statements are all true regarding parathyroid hormone (PTH) function *except:*

1) Increases activity of hepatic hydroxylase for conversion to 25 (OH) Vitamin D
3) Stimulates production of 1, 25 dihydroxy Vitamin D in the kidney
2) Increases calcium retention in the kidney via increased excretion of phosphate
5) Indirectly increases bone resorption via 1,25 dihydroxy Vitamin D
4) Directly stimulates increased gut absorption of calcium

This statement is false. PTH indirectly stimulates increased gut absorption of calcium via its direct effect of increasing renal production of active Vitamin D.Correct Answer: Directly stimulates increased gut absorption of calcium

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582. (501) Q2-698:

Which of the following individuals has the highest dietary calcium requirement:

1) A healthy growing child
3) A healthy 60-year-old post-menopausal woman
2) A healthy pregnant 23-year-old woman
5) A healthy 29-year-old post-partum lactating mother
4) A healthy adolescent

A healthy child requires approximately 400-700 mg of dietary calcium per day. An adolescent requires approximately 1300 mg per day. An adult requires 500 mg dietary of calcium per day. A pregnant woman requires 1500 mg of dietary calcium per day to support her own needs and those of the growing fetus. A post-partum lactating mother requires the highest intake of dietary calcium at 2000 mg per day. A post-menopausal woman requires roughly 1500 mg per day.Correct Answer: A healthy 29-year-old post-partum lactating mother

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583. (502) Q2-699:

Which of the following is not a facilitator of calcium absorption:

1) Parathyroid hormone
3) Gastric pH
2) 1,25 dihydroxy Vitamin D
5) Achlorhydria
4) Ca:P ratio of 1:1 or 1:2

1,25 dihydroxy Vitamin D increases the absorption of calcium and phosphorus from the small intestine. A reduction of stomach acid decreases the absorption of calcium in the gut. Parathyroid hormone indirectly stimulates gut absorption by increasing the amount of 1,25 dihydroxy Vitamin D.Correct Answer: Achlorhydria

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584. (503) Q2-701:

Laboratory findings found in rickets and/or osteomalacia, include the following *except:*

1) Decreased urinary calcium
3) Decreased serum phosphorous
2) Normal or decreased serum calcium
5) Decreased alkaline phosphatase
4) Increased parathyroid hormone

Vitamin D deficiency results in osteomalacia. The lack of Vitamin D may be secondary to dietary deficiency, gastrointestinal complications, or renal insufficiency. With a Vitamin D deficiency, one sees the following:

- Normal or decreased calcium
- Decreased serum phosphorus
- Increased serum alkaline phosphatase
- Increased serum parathyroid hormone
- Decreased serum 1,25 dihydroxy Vitamin D
- Decreased urinary calcium

Correct Answer: Decreased alkaline phosphatase

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585. (504) Q2-702:

Which of the following disease state-therapy pairs is correct:

1) Vitamin D deficiency â increased dietary phosphate and low intake of Vitamin D
3) Renal osteodystrophy â selective parathyroidectomy
2) Renal osteodystrophy â low calcium, high phospate diet.
5) Paget's disease â chronic etidronate use
4) Vitamin D resistant rickets â high intake of Vitamin D and increased dietary calcium

Renal osteodystrophy is treated with increased dietary calcium, low dietary phosphate, selective use of calcium phosphate binders, and selective parathyroidectomy (neck exploration). Paget's disease cannot be treated with longterm etidronate because this first-generation diphosphonate inhibits bone resorption and formation.Correct Answer: Renal osteodystrophy â selective parathyroidectomy

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586. (505) Q2-703:

Which of the following is *not* a form of primary hyperparathyroidism:

1) Single parathyroid adenoma
3) Parathyroid hyperplasia
2) Renal osteodystrophy
5) Multiple parathyroid adenoma
4) Malignant parathyroid tumor

Primary hyperparathyroidism can be caused by single or multiple parathyroid adenomas, parathyroid hyperplasia, or a malignant parathyroid tumor. Secondary forms include renal osteodystrophy, Vitamin D deficiency, and age-related osteoporosis.Correct Answer: Renal osteodystrophy

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587. (719) Q2-980:

Which of the following terms is used to describe a localized conduction block in a peripheral nerve in which the nerve is intact and full recovery is expected:

1) First-degree injury (neuropraxia)
3) Third-degree
2) Second-degree (axonotmesis)
5) Fifth-degree
4) Fourth-degree

A first-degree injury is a neuropraxia. There is a local conduction block in which the nerve is intact and full recovery is expected.

- First-degree: Neuropraxia, the nerve structure is intact, full recovery is expected
- Second-degree: Axonotmesis, severance of the axon leading to Wallerian degeneration, continuity of endoneurial sheath is retained, repair is orderly, complete motor and sensory loss with denervation and fibrillation potentials
- Third-degree: Injury to axons and the endoneurial tube, arrangement of individual fascicles is maintained (perineurium intact), recovery is variable
- Fourth-degree: Injury to axons, endoneurial tube, fascicles with the nerve trunk intact, Wallerian degeneration and a higher incidence of proximal nerve cell body degeneration, repair is unlikely and surgical repair of the nerve is necessary (excision and grafting)
- Fifth-degree: Loss of nerve trunk continuity, neuroma formation in the proximal stump, Wallerian degeneration distally

Correct Answer: First-degree injury (neuropraxia)

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588. (721) Q2-982:

Which of the following terms is used to describe complete severance of a peripheral nerve with loss of the nerve trunk continuity:

1) First-degree injury (neuropraxia)
3) Third-degree
2) Second-degree (axonotmesis)
5) Fifth-degree
4) Fourth-degree

A fifth-degree injury refers to complete disruption of the nerve trunk.

- First-degree: Neuropraxia, the nerve structure is intact, full recovery is expected
- Second-degree: Axonotmesis, severance of the axon leading to Wallerian degeneration, continuity of endoneurial sheath is maintained, repair is orderly, complete motor and sensory loss with denervation and fibrillation potentials
- Third-degree: Injury to axons and the endoneurial tube, arrangement of individual fascicles is maintained (perineurium intact), recovery is variable
- Fourth-degree: Injury to axons, endoneurial tube, fascicles with the nerve trunk being intact, Wallerian degeneration and a higher incidence of proximal nerve cell body degeneration, repair is unlikely and surgical repair of the nerve is necessary (excision and grafting)
- Fifth-degree: Loss of nerve trunk continuity, neuroma formation in the proximal stump, Wallerian degeneration distally

Correct Answer: Fifth-degree

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589. (722) Q2-983:

Which of the following describes the sequence in which motor and sensory nerves fail in response to an injury:

1) Motor, proprioceptor, touch, temperature, and pain
3) Touch, proprioceptor, temperature, pain, and motor
2) Pain, proprioceptor, touch, temperature, and motor
5) Proprioceptor, touch, temperature, pain, and motor
4) Temperature, touch, temperature, motor, and pain

Motor and sensory nerves fail in the following sequence:

- Motor
- Proprioceptor
- Touch
- Temperature
- Pain

Recovery is usually in the reverse order.

Correct Answer: Motor, proprioceptor, touch, temperature, and pain

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590. (723) Q2-984:

Following a traumatic nerve injury, in which time period would a physician find denervation activity with fibrillation and positive sharp waves in the affected muscles:

1) Immediately following the injury
3) 2 to 5 weeks following injury
2) 7 to 10 days following injury
5) 12 weeks following injury
4) 6 to 8 weeks following injury

Nerve conduction studies can help distinguish between the three principle types of nerve injury: neuropraxia, axonotmesis, and neurotmesis.

The following is the sequence of events following traumatic nerve injury:

Timing	**Electrophysiologic abnormality**
Onset of injury	Conduction block across nerve injury site
7 to 10 days	Reduced amplitudes on distal stimulation
2 to 5 weeks	Denervation changes on electromyographic (EMG) (fibrillation, positive sharp waves)
6 to 8 weeks	Re-innervation on EMG

Correct Answer: 2 to 5 weeks following injury

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591. (724) Q2-985:

Following a traumatic nerve injury, in which time period would a physician find re-innervation of the affected muscles:

1) Immediately following the injury
3) 2 to 5 weeks following injury
2) 7 to 10 days following injury
5) 12 weeks following injury
4) 6 to 8 weeks following injury

Nerve conduction studies can help distinguish between the three principle types of nerve injury: neuropraxia, axonotmesis, and neurotmesis.

The following is the sequence of events following traumatic nerve injury:

Timing	**Electrophysiologic abnormality**
Onset of injury	Conduction block across nerve injury site
7 to 10 days	Reduced amplitudes on distal stimulation
2 to 5 weeks	Denervation changes on electromyographic (EMG) (fibrillation, positive sharp waves)
6 to 8 weeks	Re-innervation on EMG

Correct Answer: 6 to 8 weeks following injury

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592. (725) Q2-986:

Which of the following collagen types accounts for 10% to 20% of the wet weight of articular cartilage:

1) Type I
3) Type V
2) Type II
5) Type XI
4) Type IX

Collagen type II is the most common type of collagen in articular cartilage. Other collagen types include:

Type V
Type VI
Type IX
Type X
Type XI

The major components of cartilage are:

Water: 65% to 80%
Type II collagen:10% to 20%
Aggrecan: 4% to 7%

The minor components (< 5%) of cartilage are:

Proteoglycans
Collagens â Types V, VI, IX, X, XI
Link protein
Hyaluronate
Fibronection
Lipids

Correct Answer: Type II

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593. (726) Q2-987:

The affinity of articular cartilage for water is most related to which of the following tissues:

1) Type II collagen
3) Hydrophilic nature of the proteoglycans
2) Type I collagen
5) Fibronectin
4) Link protein

The affinity of articular cartilage for water is most directly related to the hydrophilic nature of the proteglycans. Proteoglycans attract water through two physicochemical mechanisms â Donnan osmotic pressure and the electrostatic repulsive forces that are developed between the fixed negative charges along the proteoglycan molecules.

Correct Answer: Hydrophilic nature of the proteoglycans

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594. (727) Q2-988:

In which of the following articular cartilage zones is the collagen fiber oriented in a random manner:

1) Superficial tangential zone
3) Deep zone
2) Middle zone
5) Calcified zone
4) Tidemark

The collagen fibers, proteoglycans, and chondrocytes are distributed through the four articular cartilage zones:

Superficial tangential zone (gliding zone)

- Thin collagen fibrils are parallel to the articular surface
- Chondrocytes are elongated with the axis parallel to the surface
- Proteoglycan content is at the lowest level
- Water content is at the highest level

Middle zone

- Larger diameter collagen fibers/less organization (random)
- Rounded chondrocytes

Deep zone

- Collagen fibers are large and perpendicular to the articular surface
- Highest concentration of proteoglycans
- Lowest water content
- Chondrocytes are spherical and arranged in columnar fashion

Calcified zone

- Small cells in cartilage matrix encrusted with apatitic salts

*The tidemark separates the deep zone and calcified zone.*Correct Answer: Middle zone

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595. (728) Q2-989:

In which of the following articular cartilage zones is the collagen fiber oriented perpendicularly to the articular surface:

1) Superficial tangential zone
3) Deep zone
2) Middle zone
5) Tidemark
4) Calcified zone

The collagen fibers, proteoglycans, and chondrocytes are distributed through the four articular cartilage zones:

Superficial tangential zone (gliding zone)

- Thin collagen fibrils are parallel to the articular surface
- Chondrocytes are elongated with the axis parallel to the surface
- Proteoglycan content is at the lowest level
- Water content is at the highest level

Middle zone

- Larger diameter collagen fibers/less organization
- Rounded chondrocytes

Deep zone

- Collagen fibers are large and perpendicular to the articular surface
- Highest concentration of proteoglycans
- Lowest water content
- Chondrocytes are spherical and arranged in columnar fashion

Calcified zone

- Small cells in cartilage matrix encrusted with apatitic salts

*The tidemark separates the deep zone and calcified zone.*Correct Answer: Deep zone

596. (729) Q2-990:

In which of the following articular cartilage zones are the collagen fibers oriented parallel to the articular cartilage surface:

1) Superficial tangential zone
3) C. Deep zone
2) B. Middle zone
5) E. Calcified zone
4) D. Tidemark

The collagen fibers, proteoglycans, and chondrocytes are distributed through the four articular cartilage zones:

Superficial tangential zone (gliding zone)

- Thin collagen fibrils are parallel to the articular surface
- Chondrocytes are elongated with the axis parallel to the surface
- Proteoglycan content is at the lowest level
- Water content is at the highest level

Middle zone

- Larger diameter collagen fibers/less organization
- Rounded chondrocytes

Deep zone

- Collagen fibers are large and perpendicular to the articular surface
- Highest concentration of proteoglycans
- Lowest water content
- Chondrocytes are spherical and arranged in columnar fashion

Calcified zone

- Small cells in cartilage matrix encrusted with apatitic salts

*The tidemark separates the deep zone and calcified zone.*Correct Answer: Superficial tangential zone

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597. (730) Q2-991:

The tidemark in articular cartilage separates which of the following two zones:

1) The superficial tangential zone and the middle zone
3) The superficial zone and the deep zone
2) The middle zone and the deep zone
5) The calcified cartilage zone and the subchondral bone zone
4) The deep zone and the calcified zone

The collagen fibers, proteoglycans, and chondrocytes are distributed through the four articular cartilage zones:

Superficial tangential zone (gliding zone)

- Thin collagen fibrils are parallel to the articular surface
- Chondrocytes are elongated with the axis parallel to the surface
- Proteoglycan content is at the lowest level
- Water content is at the highest level

Middle zone

- Larger diameter collagen fibers/less organization
- Rounded chondrocytes

Deep zone

- Collagen fibers are large and perpendicular to the articular surface
- Highest concentration of proteoglycans
- Lowest water content
- Chondrocytes are spherical and arranged in columnar fashion

Calcified zone

- Small cells in cartilage matrix encrusted with apatitic salts

*The tidemark separates the deep zone and calcified zone.*Correct Answer: The deep zone and the calcified zone

598. (731) Q2-992:

In which of the articular cartilage zones is the highest concentration of proteoglycans:

1) Superficial tangential zone
3) Deep zone
2) Middle zone
5) Tidemark
4) Calcified cartilage zone

The collagen fibers, proteoglycans, and chondrocytes are distributed through the four articular cartilage zones:

Superficial tangential zone (gliding zone)

- Thin collagen fibrils are parallel to the articular surface
- Chondrocytes are elongated with the axis parallel to the surface
- Proteoglycan content is at the lowest level
- Water content is at the highest level

Middle zone

- Larger diameter collagen fibers/less organization
- Rounded chondrocytes

Deep zone

- Collagen fibers are large and perpendicular to the articular surface
- Highest concentration of proteoglycans
- Lowest water content
- Chondrocytes are spherical and arranged in columnar fashion

Calcified zone

- Small cells in cartilage matrix encrusted with apatitic salts

*The tidemark separates the deep zone and calcified zone.*Correct Answer: Deep zone

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599. (732) Q2-993:

In which of the following articular cartilage zones is the highest water content:

1) Superficial tangential zone
3) Deep zone
2) Middle zone
5) Tidemark
4) Calcified zone

The collagen fibers, proteoglycans, and chondrocytes are distributed through the four articular cartilage zones:

Superficial tangential zone (gliding zone)

- Thin collagen fibrils are parallel to the articular surface
- Chondrocytes are elongated with the axis parallel to the surface
- Proteoglycan content is at the lowest level
- Water content is at the highest level

Middle zone

- Larger diameter collagen fibers/less organization
- Rounded chondrocytes

Deep zone

- Collagen fibers are large and perpendicular to the articular surface
- Highest concentration of proteoglycans
- Lowest water content
- Chondrocytes are spherical and arranged in columnar fashion

Calcified zone

- Small cells in cartilage matrix encrusted with apatitic salts

*The tidemark separates the deep zone and calcified zone.*Correct Answer: Superficial tangential zone

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600. (733) Q2-994:

Which of the following collagens acts as a nuclei for deposition of type II collagen in articular cartilage:

1) Type I
3) Type IX
2) Type III
5) Type XII
4) Type XI

The strength of articular cartilage comes in part from the relative insolubility of cartilage collagens. This insolubility is secondary to the extensive cross-linking. There are a number of factors for this cross-linking:

- Covalent cross links in type II collagen
- Links between types II and type IX
- Links between chains of type XI

Type XI collagen can form thin fibrils and it is thought that these fibrils act as a nuclei for type II collagen deposition.

Correct Answer: Type XI

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601. (734) Q2-995:

Which of the following collagens stabilizes the collagen network by linking the type II collagen fibrils:

1) Type I
3) Type IX
2) Type III
5) Type XII
4) Type X

The strength of articular cartilage comes in part from the relative insolubility of cartilage collagens. This insolubility is secondary to the extensive cross-linking. There are a number of factors for this cross-linking:

- Covalent cross links in type II collagen
- Links between types II and type IX
- Links between chains of type XI

Type IX collagen stabilizes the collagen network by linking the type II collagen fibers.

Correct Answer: Type IX

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602. (735) Q2-996:

Which of the following is the most prevalent glycosaminoglycan in articular cartilage:

1) Keratan sulfate
3) Hyaluronate
2) Chondroitin sulfate
5) Fibromodulin
4) Dermatan sulfate

The three major types of glycosaminoglycans in articular cartilage are chondroitin sulfate, keratan sulfate, and dermatan sulfate. *Chondroitin sulfate is the most common glycosaminoglycan in articular cartilage.* Chondroitin 4-sulfate and chondroitin 6-sulfate isomers account for 55% to 90% of the total amount.

The glycosaminoglycan chains contain repeating carboxyl and sulfate groups that become ionized in solution. These free-floating ions account for the Donnan osmotic pressure and the large charge-to-charge repulsive forces of the glycosaminoglycan chains.

Most of the glycosaminoglycans are in the form of large aggregates called aggrecan. Link protein binds to both the G1 domain of aggrecan and the hyaluron to form the aggrecan-hyaluronate-link protein complexes, which are called proteoglycan aggregates.

Correct Answer: Chondroitin sulfate

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603. (736) Q2-997:

Which of the following binds to both the G1 domain of large aggregating type of proteoglycans (aggrecan molecule) and hyaluron:

1) Keratan sulfate
3) Fibromodulin
2) Chondroitin sulfate
5) Link protein
4) Dermatan sulfate

The three major types of glycosaminoglycans in articular cartilage are chondroitin sulfate, keratan sulfate, and dermatan sulfate. Chondroitin sulfate is the most common glycosaminoglycan in articular cartilage. Chondroitin 4-sulfate and chondroitin 6-sulfate isomers account for 55% to 90% of the total amount.

The glycosaminoglycan chains contain repeating carboxyl and sulfate groups that become ionized in solution. These free-floating ions account for the Donnan osmotic pressure and the large charge-to-charge repulsive forces of the glycosaminoglycan chains.

Most of the glycosaminoglycans are in the form of large aggregates called aggrecan. *Link protein binds to both the G1 domain of aggrecan and the hyaluron chain to form the aggrecan-hyaluronate-link protein complexes, which are called proteoglycan aggregates.*

Correct Answer: Link protein

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604. (737) Q2-998:

Which of the following proteoglycans is involved with collagen fibrillogenesis and fibril diameter:

1) Chondroitin sulfate
3) Fibromodulin
2) Keratan sulfate
5) Biglycan
4) Decorin

Biglycan and decorin are two small proteoglycans (biglycan has two dermatan sulfate chains and decorin contains one dominant sulfate chain). Decorin is located on the surface of collagen fibrils and is believed to be involved with fibrillogenesis and fibril diameter.

Correct Answer: Decorin

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605. (738) Q2-999:

To which of the following long and unbranched molecules does link protein form a bond with G1 domain of aggrecan:

1) Chondroitin 4-sulfate
3) Keratan sulfate
2) Chondroitin 6-sulfate
5) Dermatan sulfate
4) Hyaluronate

Link protein binds to both the G1 domain of aggrecan and the hyaluronate chain forming the aggregan-hyaluronate-link protein complexes referred to as proteoglycan aggregates.

Correct Answer: Hyaluronate

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606. (739) Q2-1000:

Adult articular cartilage receives its nutrition through which of the following mechanisms:

1) Fine capillary network from the synovial tissues
3) Fine capillary network from the perichondral ring
2) Fine capillary network through the subchondral bone
5) Diffusion from the synovial fluid through small pores
4) Diffusion from the synovial fluid through large pores

Articular cartilage receives its nutrition through small pores (approximately 50 angstroms) from the synovial fluid. Adult articular cartilage has no blood supply. Diffusion rates vary between 10 seconds to 1 hour. Degradation products are able to leave the cartilage rapidly.

Correct Answer: Diffusion from the synovial fluid through small pores

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607. (740) Q2-1001:

In which of the following sites are the glycosaminoglycan chains added to the protein cores:

1) Nucleus
3) Secretory vesicles
2) Golgi apparatus
5) Extracellular matrix
4) Pericellular matrix

The proteins for glycosaminoglycan synthesis are synthesized in the ribosomes. *The glycosaminoglycan chains are added in the Golgi apparatus.* Protoeglycan aggregates are formed in the extracellular matrix where link protein, hyaluronate, and aggrecan come together. Many factors may influence the quantity and makeup of the proteoglycans.

Glycosaminoglycan chains are formed intracellularly, whereas large proteoglycan aggregates are formed outside the cell in the extracellular matrix.

Correct Answer: Golgi apparatus

608. (741) Q2-1002:

In which of the following sites does aggrecan, link protein, and hyaluronate come together to form the proteoglycan aggregate:

1) Secretory vesicles
3) Extracellular matrix
2) Pericellular matrix
5) Golgi apparatus
4) Nucleus

The proteins for glycosaminoglycan synthesis are synthesized in the ribosomes (hence, intracellular). The glycosaminoglycan chains are added in the Golgi apparatus. *Protoeglycan aggregates are formed in the extracellular matrix where link protein, hyaluronate, and aggrecan come together.* Many factors may influence the quantity and makeup of the proteoglycans.

Correct Answer: Extracellular matrix

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609. (742) Q2-1003:

Which of the following statements is true concerning the changes seen in human articular cartilage as a person ages (normal cartilage):

1) Progressive increase in chondroitin 4-sulfate
3) Progressive decrease in collagen concentration
2) Progressive decrease in chondroitin 6-sulfate
5) Progressive increase in keratan sulfate concentration
4) Progressive increase in collagen concentration

There are several important points concerning aging and articular cartilage. The collagen content increases quickly after birth, attaining adult levels, and then it does not materially change. The water level is high in immature individuals but remains constant in the adult. In contrast to the stable levels of collagen and water, the proteoglycan composition changes:

- Chondroitin 4-sulfate levels progressively decrease.
- Chondroitin 6-sulfate levels progressively increase.
- Keratan sulfate levels progressively increase in the human. At age 30, the level increases to 25% to 50% of proteoglycan content.
- Aggregation decreases with advancing age.

Correct Answer: Progressive increase in keratan sulfate concentration

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610. (743) Q2-1004:

Which of the following two components account for the biphasic behavior of cartilage:

1) Chondroitin 4-sulfate and chondroitin 6-sulfate
3) Collagen and proteoglycans
2) Chondroitin 6-sulfate and keratan sulfate
5) Collagen and fibronectin
4) Water and the solid matrix of cartilage (collagen and proteoglycans)

Cartilage is a biphasic material. *Water and the solid matrix (collagen and the proteoglycans) account for this behavior.* Articular cartilage is viscoelastic and will exhibit time-dependent behavior. There are two mechanisms for the viscoelasticity. One mechanism is flow independent. The flow independent behavior derives from the collagen-proteoglycan matrix. The flow dependent mechanism depends on the interstitial fluid flow and pressurization.

Cartilage must be compressed for 2.5 to 6 hours before the interstitial fluid flow ends and the load is fully borne by the collagen proteoglycan matrix (this virtually never happens in humans). The ratio of load supported by the fluid pressure to that supported by solid matrix is greater than 20:1.

In osteoarthritis cartilage, there is increased water content and decreased proteoglycan content. These changes increase cartilage permeability and lower the ability to carry load.

Correct Answer: Water and the solid matrix of cartilage (collagen and proteoglycans)

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611. (744) Q2-1005:

Which of the following changes occurs in the articular cartilage following immobilization of a joint:

1) Increase in proteoglycan concentration
3) Increase in type II collagen
2) Decrease in proteoglycan concentration
5) Increase in type IX collagen
4) Decrease in type II collagen

Reduced joint motion and loading results in decreased proteoglycan concentration. Collagen concentration does not change. Normal tensile properties are maintained which reflect the relatively constant collagen concentration. Nutrition of the joint decreases because of reduced loading.

Correct Answer: Decrease in proteoglycan concentration

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612. (745) Q2-1006:

Which of the following collagens forms part of the matrix immediately surrounding the chondrocytes and may help attach the chondrocyte to the matrix macromolecular framework:

1) Type II
3) Type XI
2) Type IX
5) Type X
4) Type VI

Type II, IX, and XI collagen forms a fibrillar network that gives cartilage its form and tensile stiffness and strength. *Type VI collagen forms part of the matrix immediately surrounding chondrocytes and may help attach the cells attach to the matrix macromolecular framework.*

Correct Answer: Type VI

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613. (746) Q2-1007:

A genetic mutation accounts for the manifestations of achondroplasia. Which of the following proteins has a genetic mutation that has been linked to achondroplasia:

1) Fibroblast growth factor (FGF) receptor 3
3) Fibrillin
2) Type I collagen
5) Cartilage oligomeric matrix protein (COMP)
4) Type II collagen

The genetic defect in achondroplasia involves fibroblast growth factor (FGF) receptor 3.

The other answers refer to:

- Osteogenesis imperfecta — Type I collagen
- Marfan syndrome — Fibrillin
- Spondyloepiphyseal dysplasia — Type II collagen
- Pseudoachondroplasia — Cartilage oligomeric matrix protein (COMP)

Correct Answer: Fibroblast growth factor (FGF) receptor 3

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614. (747) Q2-1008:

A genetic mutation accounts for the manifestations of osteogenesis imperfecta. Which of the following factors has a genetic mutation that has been linked to osteogenesis imperfecta:

1) Fibroblast growth factor (FGF) receptor 3
3) Cartilage oligomeric matrix protein (COMP)
2) Type I collagen
5) Type II collagen
4) Fibrillin

Osteogenesis imperfecta has been linked to defect in type I collagen.

The other answers refer to:

- Achondroplasia — Fibroblast growth factor (FGF) receptor 3
- Marfan syndrome — Fibrillin
- Spondyloepiphyseal dysplasia — Type II collagen
- Pseudoachondroplasia — Cartilage oligomeric matrix protein (COMP)

Correct Answer: Type I collagen

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615. (748) Q2-1009:

A genetic mutation accounts for the manifestations of pseudoachondroplasia. Which of the following factors has a genetic mutation that has been linked to pseudoachondroplsia:

1) Fibroblast growth factor (FGF) receptor 3
3) Cartilage oligomeric matrix protein (COMP)
2) Type I collagen
5) Type II collagen
4) Fibrillin

The genetic defect in pseudoachondroplasia involves cartilage oligomeric matrix protein (COMP).

The other answers refer to:

- Achondroplasia — Fibroblast growth factor (FGF) receptor 3
- Marfan syndrome — Fibrillin
- Spondyloepiphyseal dysplasia — Type II collagen
- Osteogenesis imperfecta — Type I collagen

Correct Answer: Cartilage oligomeric matrix protein (COMP)

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616. (749) Q2-1010:

A genetic mutation accounts for the manifestations of Marfan syndrome. Which of the following factors has a genetic mutation that has been linked to Marfan syndrome:

1) Fibroblast growth factor (FGF) receptor 3
3) Cartilage oligomeric matrix protein (COMP)
2) Type I collagen
5) Type II collagen
4) Fibrillin

The molecular defect in Marfan syndrome involves fibrillin.

The other answers refer to:

- Achondroplasia — Fibroblast growth factor (FGF) receptor 3
- Pseudoachondroplasia — Cartilage oligomeric matrix protein (COMP)
- Spondyloepiphyseal dysplasia — Type II collagen
- Osteogenesis imperfecta — Type I collagen

Correct Answer: Fibrillin

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617. (750) Q2-1011:

A genetic mutation accounts for the manifestations of spondyloepiphyseal dysplasia. Which of the following factors has a genetic mutation that has been linked to spondyloepiphyseal dysplasia:

1) Fibroblast growth factor (FGF) receptor 3
3) Cartilage oligomeric matrix protein (COMP)
2) Type I collagen
5) Type II collagen
4) Fibrillin

The genetic defect in spondyloepiphyseal dysplasia involves type II collagen.

The other answers refer to:

- Achondroplasia — Fibroblast growth factor (FGF) receptor 3
- Pseudoachondroplasia — Cartilage oligomeric matrix protein (COMP)
- Marfan syndrome — Fibrillin
- Osteogenesis imperfecta — Type I collagen

Correct Answer: Type II collagen

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618. (751) Q2-1012:

A genetic mutation accounts for the manifestations of Duchenne muscular dystrophy. Which of the following factors has a genetic mutation that has been linked to Duchenne muscular dystrophy:

1) Dystrophin
3) Carbonic anhydrase type II proton pump
2) PEX (a cellular endopeptidase)
5) EXT1, EXT2 genes
4) Gs alpha (receptor-coupled signaling protein)

In Duchenne muscular dystrophy, the genetic defect involves dystrophin.

The other answers refer to:

- X-linked hypophosphatemic rickets — PEX (a cellular endopeptidase)
- Osteopetrosis — Carbonic anhydrase type II proton pump
- Fibrous dysplasia — Gs alpha (receptor-coupled signaling protein)
- Multiple hereditary exostoses — EXT1, EXT2 genes

Correct Answer: Dystrophin

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619. (752) Q2-1013:

A genetic mutation accounts for the manifestations of X-linked hypophosphatemic rickets. Which of the following factors has a genetic mutation that has been linked to X-linked hypophosphatemic rickets:

1) Dystrophin
3) Carbonic anhydrase type II proton pump
2) PEX (a cellular endopeptidase)
5) EXT1, EXT2 genes
4) Gs alpha (receptor-coupled signaling protein)

The genetic defect in X-linked hypophosphatemic rickets involves PEX (a cellular endopeptidase).

The other answers refer to:

- Duchenne muscular dystrophy Â — Dystrophin
- Osteopetrosis — Carbonic anhydrase type II proton pump
- Fibrous dysplasia — Gs alpha (receptor-coupled signaling protein)
- Multiple hereditary exostoses — EXT1, EXT2 genes

Correct Answer: PEX (a cellular endopeptidase)

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620. (753) Q2-1014:

A genetic mutation accounts for the manifestations of osteopetrosis. Which of the following factors has a genetic mutation that has been linked to osteopetrosis:

1) Dystrophin
3) Carbonic anhydrase type II proton pump
2) PEX (a cellular endopeptidase)
5) EXT1, EXT2 genes
4) Gs alpha (receptor-coupled signaling protein)

The genetic defect in osteopetrosis involves the carbonic anhydrase type II proton pump.

The other answers refer to:

• Duchenne muscular dystrophy Â	Dystrophin
• X-linked hypophosphatemic rickets	PEX (a cellular endopeptidase)
• Fibrous dysplasia	Gs alpha (receptor-coupled signaling protein)
• Multiple hereditary exostoses	EXT1, EXT2 genes

Correct Answer: Carbonic anhydrase type II proton pump

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621. (754) Q2-1015:

A genetic mutation accounts for the manifestations of fibrous dysplasia. Which of the following factors has a genetic mutation that has been linked to fibrous dysplasia:

1) Dystrophin
3) Carbonic anhydrase type II proton pump
2) PEX (a cellular endopeptidase)
5) EXT1, EXT2 genes
4) Gs alpha (receptor-coupled signaling protein)

The genetic defect in fibrous dysplasia involves an activity mutation of Gs alpha (a receptor coupled signaling protein).

The other answers refer to:

• Duchenne muscular dystrophy Â	Dystrophin
• X-linked hypophosphatemic rickets	PEX (a cellular endopeptidase)
• Osteopetrosis	Carbonic anhydrase type II proton pump
• Multiple hereditary exostoses	EXT1, EXT2 genes

Correct Answer: Gs alpha (receptor-coupled signaling protein)

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622. (755) Q2-1016:

A genetic mutation accounts for the manifestations of multiple hereditary exostoses. Which of the following factors has a genetic mutation that has been linked to hereditary exostoses:

1) Dystrophin
3) Carbonic anhydrase type II proton pump
2) PEX (a cellular endopeptidase)
5) EXT1, EXT2 genes
4) Gs alpha (receptor-coupled signaling protein)

The genetic defect in multiple hereditary exostoses involves EXT1 and EXT2 genes.

The other answers refer to:

- Duchenne muscular dystrophy — Dystrophin
- X-linked hypophosphatemic rickets — PEX (a cellular endopeptidase)
- Osteopetrosis — Carbonic anhydrase type II proton pump
- Fibrous dysplasia — Gs alpha (receptor-coupled signaling protein)

Correct Answer: EXT1, EXT2 genes

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623. (756) Q2-1017:

Which of the following types of bone behaves in an isotropic manner when loaded in different directions:

1) Lamellar bone
3) Cortical bone
2) Woven bone
5) Plexiform bone
4) Cancellous bone

Woven bone is immature bone that is found in newborns, fracture callus, and the metaphyses of growing bone. In woven bone, the collagen fibers are oriented in a completely random fashion. When woven bone is loaded, it performs in an isotropic manner. The other types of bone (lamellar, cortical, cancellous, and plexiform) contain collagen that is oriented along the long axis of the bone and cause the bone to perform anisotropically.

Correct Answer: Woven bone

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624. (757) Q2-1018:

Haversian bone is composed of vascular channels surrounded circumferentially by lamellar bone. Which of the following terms is used to describe the unit of bone composed of a neurovascular channel surrounded by a cell-permeated layer of bone matrix:

1) Bone remodeling unit
3) Osteon
2) Plexiform bone
5) Canaliculi
4) Volkman unit

The osteon is a unique arrangement of bone cells and matrix surrounding a blood vessel. The osteon is an irregular branching, anastomosing cylinder composed of a centrally placed neurovascular canal surrounded by cell-permeated layers of bone matrix.

- The bone remodeling unit refers to the cutting cone of leading osteoclasts and following osteoblasts.
- Plexiform bone is a structural type of bone found in large animals where rapid bone growth occurs. There are alternating layers of lamellar and woven bone.
- Volkman canals are the channels connecting different osteons or Haversian units.
- Canaliculi are small channels through which the cell processes of the osteocytes connect to each other.

Correct Answer: Osteon

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625. (758) Q2-1019:

The normal porosity of cortical bone is:

1) 5%
3) 20%
2) 10%
5) 30%
4) 25%

The normal porosity of cortical bone is 10% compared to trabecular bone, which is 50% to 90%. Cortical bone porosity occurs because of the Haversian and Volkman canals and, to a lesser extent, from the osteocyte lacunae and canaliculi.

Trabecular bone is arranged as a series of interconnecting small plates and rods. The porosity may vary between 50% to 90%. This porosity is secondary to the spaces between the trabecular pieces of bone rather than voids in the actual pieces of trabecular bone.

Correct Answer: 10%

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626. (759) Q2-1020:

The normal porosity of trabecular bone is:

1) 10%
3) 30%
2) 20%
5) 50% to 90%
4) 40%

Trabecular bone is arranged as a series of interconnecting small plates and rods. The porosity may vary between 50% to 90%. This porosity is secondary to the spaces between the trabecular pieces of bone rather than voids in the actual pieces of trabecular bone.

The normal porosity of cortical bone is 10%. Cortical bone porosity occurs because of the Haversian and Volkman canals and, to a lesser extent, from the ostocyte lacunae and canaliculi.

Correct Answer: 50% to 90%

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627. (760) Q2-1021:

Which of the following cells produce osteocalcin and bone sialoprotein:

1) Osteocytes
3) Mast cells
2) Osteoblasts
5) Fibroblasts
4) Osteoclasts

Osteoblasts are metabolically active cells that line the bone surface. Osteoblasts produce type I collagen and many noncollagenous proteins such as osteocalcin, bone sialoprotein, and extracellular matrix proteins. Osteoblasts have large amounts of rough endoplasmic reticulum because they prepare large amounts of protein for export out of the cell. The Golgi apparatus exports the protein.

Correct Answer: Osteoblasts

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628. (761) Q2-1022:

Osteoblasts predominantly form which of the following types of collagen:

1) Type VI
3) Type X
2) Type IX
5) Type II
4) Type I

Osteoblasts produce type I collagen. This is the major type of collagen found in bone. Type I collagen is the only collagen capable of mineralization.

Correct Answer: Type I

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629. (762) Q2-1023:

Osteocytes differ from osteoblasts because osteocytes:

1) Have a higher nucleus to cytoplasm ratio
3) Line the bone surfaces
2) Have a larger number of organelles
5) Have alkaline phosphatase that is distributed over the outer surface of the cell
4) Are isolated individually from other bone cells

Osteoblasts that become imbedded into the bone matrix become osteocytes. Osteocytes are less metabolically active because they do not produce large amounts of protein for export. Thus, osteocytes have a higher nucleus to cytoplasm ratio than osteoblasts. Osteocytes have fewer organelles as they do not need extensive intracellular machinery to export protein products.

Osteocytes have extensive connections with other osteocytes through the cell processes that travel through the canaliculi. Strain generated signals such as cell deformation, streaming potentials, or shear stress by fluid flow could be perceived by the osteocytes and passed on to other cells.

Osteocytes do not line the bone surface as osteoblasts do. In addition, osteoblasts have alkaline phosphatase covering the cell membranes.

Correct Answer: Have a higher nucleus to cytoplasm ratio

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630. (763) Q2-1024:

Which of the following is characteristic of an active osteoclast:

1) A large amount of rough endoplasmic reticulum
3) Ruffled border adjacent to the bone surface
2) Paucity of intracellular smooth vesicles
5) Low acid phosphatase activity
4) Few mitochondria

Active osteoclasts resorb the mineral and organic matrix of bone. Active osteoclasts also attach the cell to exposed bone matrix. When osteoclasts are studied with an electron microscope, there are two prominent findings â a ruffled border and a clear zone. In the clear zone, the osteoclast seals off the area of bone to be resorbed and attaches to the bone surface through a receptor-mediated process with the assistance of proteins called integrins. The ruffled border is an area found in the infoldings of the cell membrane. At the area of the ruffled border, the osteoclasts lower the pH with hydrogen ions through the carbonic anhydrase system. This lowered pH increases the solubility of the apatite crystals and the mineral can be removed. The organic components of the bone are then hydrolyzed through acidic proteolytic digestion.

Correct Answer: Ruffled border adjacent to the bone surface

---

631. (764) Q2-1025:

Osteoclasts bind to the bone surface through which of the following proteins:

1) Osteocalcin (bone Gla protein)
3) Osteopontin (bone sialoprotein 1)
2) Integrins
5) Bone sialoprotein 2
4) Fibromodulin

Active osteoclasts resorb the mineral and organic matrix of bone. Active osteoclasts also attach the cell to exposed bone matrix. When osteoclasts are studied with an electron microscope, there are two prominent findings â a ruffled border and a clear zone. In the clear zone, the osteoclast seals off the area of bone to be resorbed and attaches to the bone surface through a receptor-mediated process with the assistance of proteins called integrins. The ruffled border is an area found in the infoldings of the cell membrane. At the area of the ruffled border, the osteoclasts lower the pH with hydrogen ions through the carbonic anhydrase system. This lowered pH increases the solubility of the apatite crystals and the mineral can be removed. The organic components of the bone are then hydrolyzed through acidic proteolytic digestion.

Correct Answer: Integrins

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632. (765) Q2-1026:

Which of the following cells receive the majority of systemic endocrine-based signals for control of bone metabolism:

1) Osteocytes
3) Osteoclasts
2) Osteoblasts
5) Platelets
4) Mast cells

Osteoblasts have receptors for parathyroid hormone, vitamin D, testosterone, thyroid hormone, and glucocorticoids. Osteoblasts receive the majority of systemic endocrine-based signals. The osteoblasts, which are in physical contact with the osteocytes through osteocytic cell processes, transmit the signals to the osteoclasts.

In contrast, strain generated signals, such as cell deformation, streaming potentials, or shear stress caused by fluid flow, are received by the osteocyte and transmitted to other cells.

Correct Answer: Osteoblasts

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633. (766) Q2-1027:

Resting bone-lining cells have which of the following functions:

1) Produce acid phosphatase
3) Lower the pericellular pH through the carbonic anhydrase system
2) Produce enzyme regulatory proteins (e.g., collagenase and plasminogen activator)
5) Produce large amounts of type I collagen
4) Receive strain generated signals such as cell deformation

Osteoblasts can be active metabolically or in a resting phase. Active osteoblasts are plump in shape with a low nucleus to cytoplasm ratio and they produce and excrete both type I collagen and noncollagenous proteins that make up the bone matrix.

In contrast, resting bone-lining cells are not metabolically active compared to the active osteoblasts. The resting bone-lining cells are elongated and flat. These cells secrete enzyme-regulating proteins such as collagenase, collagenase inhibitor, and plasminogen activator. These enzymes help to control bone degradation. The osteoblasts respond to parathyroid hormone, 1,25 dihydroxyvitamin D3, and prostaglandins of the E series. The osteoblasts withdraw from the bone surface, begin degradation with their enzymes, and then the osteoclasts move in and resorb the inorganic and organic matrix of bone.

Correct Answer: Produce enzyme regulatory proteins (e.g., collagenase and plasminogen activator)

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634. (767) Q2-1028:

Which of the following cells have receptors for the hormone estrogen:

1) Osteoclasts
3) Lymphocytes
2) Osteocytes
5) Mast cells
4) Osteoblasts

Osteoblasts have receptors for parathyroid hormone, prostaglandins, 1,25 dihydroxyvitamin D3, glucocorticoids, and estrogen. Although the osteoblasts have receptors for estrogen, their exact role is unknown.

Correct Answer: Osteoblasts

---

635. (768) Q2-1029:

Osteoclasts are activated following disruption of the osteoid layer that covers the bone surface. Which of the following cells is responsible for this disruption:

1) Osteoclasts
3) Active osteoblasts
2) Resting bone-lining cells
5) Mast cells
4) Macrophages

The resting bone-lining cells (flat, elongated osteoblasts) begin the bone resorption process by secreting collagenases that degrade the osteoid layer covering bone. These cells may also contract to expose the bone surface and allow access for the osteoclasts.

Parathyroid hormone (PTH) mediates bone resorption by stimulation of PTH receptors on the osteoblasts. Osteoclasts do not have receptors for PTH.

Correct Answer: Resting bone-lining cells

---

636. (769) Q2-1030:

Which of the following areas of the osteoclast is responsible for attachment to the bone surface prior to the bone resorption process:

1) Golgi apparatus
3) Clear zone
2) Ribosome
5) Secretory vesicles
4) Ruffled border

Active osteoclasts resorb the mineral and organic matrix of bone and attach to the exposed bone matrix. When osteoclasts are studied with an electron microscope, there are two prominent findings â a ruffled border and a clear zone. In the clear zone, the osteoclast seals off the area of bone to be resorbed by attaching to the bone surface. The osteoclast attaches to the bone surface through a receptor-mediated process with the assistance of proteins called integrins. The ruffled border is an area found in the infoldings of the cell membrane. At the area of the ruffled border, the osteoclasts lower the pH with hydrogen ions through the carbonic anhydrase system. This lowered pH increases the solubility of the apatite crystals and the mineral can be removed. The organic components of the bone are then hydrolyzed through acidic proteolytic digestion.

Correct Answer: Clear zone

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637. (770) Q2-1031:
Which of the following cells have receptors for parathyroid hormone:

1) Osteoclasts
3) Lymphocytes
2) Osteoblasts
5) Fibroblasts
4) Mast cells

Parathyroid hormone (PTH) mediates bone resorption by stimulation of PTH receptors on the osteoblasts. Osteoclasts do not have receptors for PTH.

Correct Answer: Osteoblasts

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638. (771) Q2-1032:
Water comprises what percentage of bone composition:

1) 5% to 8%
3) 30%
2) 20%
5) 50%
4) 40%

Bone has the following composition:

Mineral or inorganic phase	70%
Water	5% to 8%
Organic matrix	22% to 25%
Collagen type I	90%
Noncollagenous proteins	5% to 8%

Correct Answer: 5% to 8%

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639. (772) Q2-1033:
With regard to the organic phase of bone, which of the following accounts for 90% of the organic matrix:

1) Type I collagen
3) Osteonectin
2) Type II collagen
5) Matrix Gla protein
4) Osteocalcin (bone Gla protein)

Bone has the following composition:

Mineral or inorganic phase	70%
Water	5% to 8%
Organic matrix	22% to 25%
Collagen type I	90%
Noncollagenous proteins	5% to 8%

Correct Answer: Type I collagen

---

640. (773) Q2-1034:

Which of the following proteins helps in the initiation of mineral nucleation in the initial stages of mineralization:

1) Bone sialoprotein (bone sialoprotein 2)
3) Type II collagen
2) Osteocalcin (bone Gla protein)
5) Decorin
4) Aggrecan

Bone sialoproteins are important in the initiation of mineralization of collagen. They promote apatite nucleation and growth of the crystals. Osteocalcin (bone Gla protein) is important for mineral proliferation and maturation.

Note the role of promoters and inhibitors:

Apatite nucleation and growth

Promoters

- Type I collagen
- Bone sialoprotein
- Matrix vesicles
- Phosphoproteins
- Proteolipids
- Biglycan

Inhibitors

- Large proteoglycans
- Pyrophosphate
- Adenosine triphosphate
- Citrate

Mineral proliferation

Regulators

- Osteocalcin
- Phosphoproteins
- Proteoglycans

Correct Answer: Bone sialoprotein (bone sialoprotein 2)

641. (774) Q2-1035:

Which of the following noncollagenous proteins aid in regulating the maturation of bone mineral crystals:

1) Aggrecan
3) Bone sialoprotein (bone sialoprotein 2)
2) Vitronectin
5) Osetocalcin (bone Gla protein)
4) Osteopontin (bone sialoprotein 1)

Bone sialoproteins are important in the initiation of mineralization of collagen. They promote apatite nucleation and growth of the crystals. Osteocalcin (bone Gla protein) is important for mineral proliferation and maturation.

Note the role of promoters and inhibitors:

Apatite nucleation and growth

Promoters

- Type I collagen
- Bone sialoprotein
- Matrix vesicles
- Phosphoproteins
- Proteolipids
- Biglycan

Inhibitors

- Large proteoglycans
- Pyrophosphate
- Adenosine triphosphate
- Citrate

Mineral proliferation

Regulators

- Osteocalcin
- Phosphoproteins
- Proteoglycans

Correct Answer: Osetocalcin (bone Gla protein)

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642. (775) Q2-1036:

Which of the connective tissue collagens may facilitate calcification in the holes and pores of bone collagen fibrils:

1) Type I
3) Type I, II, VI, and XI
2) Type I and II
5) Type X
4) Type IX and X

Only type I collagen is capable of supporting mineralization.

Correct Answer: Type I

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643. (776) Q2-1037:

Which of the following promotes physiologic calcification at the level of apatite nucleation and growth:

1) Phosphoproteins
3) Pyrophosphates
2) Large proteoglycans
5) Citrate
4) Adenosine triphosphate (ATP)

Bone sialoproteins (phosphoproteins) are important in the initiation of mineralization of collagen. They promote apatite nucleation and growth of the crystals. Large proteoglycans, pyrophosphates, adenosine triphosphate, and citrate are all inhibitors.

Note the role of promoters and inhibitors:

Apatite nucleation and growth

Promoters

- Type I collagen
- Bone sialoprotein
- Matrix vesicles
- Phosphoproteins
- Proteolipids
- Biglycan

Inhibitors

- Large proteoglycans
- Pyrophosphate
- Adenosine triphosphate
- Citrate

Mineral proliferation

Regulators

- Osteocalcin
- Phosphoproteins
- Proteoglycans

Correct Answer: Phosphoproteins

644. (777) Q2-1038:

Which of the following promotes physiologic calcification at the level of apatite nucleation and growth:

1) Bone sialoprotein
3) Pyrophosphates
2) Large proteoglycans
5) Citrate
4) Adenosine triphosphate

Bone sialoproteins are important in the initiation of mineralization of collagen. They promote apatite nucleation and growth of the crystals. Large proteoglycans, pyrophosphates, adenosine triphosphate, and citrate are all inhibitors.

Note the role of promoters and inhibitors:

Apatite nucleation and growth

Promoters

- Type I collagen
- Bone sialoprotein
- Matrix vesicles
- Phosphoproteins
- Proteolipids
- Biglycan

Inhibitors

- Large proteoglycans
- Pyrophosphate
- Adenosine triphosphate
- Citrate

Mineral proliferation

Regulators

- Osteocalcin
- Phosphoproteins
- Proteoglycans

Correct Answer: Bone sialoprotein

645. (778) Q2-1039:

Which of the following promotes physiologic calcification at the level of apatite nucleation and growth:

1) Matrix vesicles
3) Pyrophosphates
2) Large proteoglycans
5) Citrate
4) Adenosine triphosphate

Matrix vesicles are important in the initiation of mineralization of collagen. They promote apatite nucleation and growth of the crystals. Large proteoglycans, pyrophosphates, adenosine triphosphate, and citrate are all inhibitors.

Note the role of promoters and inhibitors:

Apatite nucleation and growth

Promoters

- Type I collagen
- Bone sialoprotein
- Matrix vesicles
- Phosphoproteins
- Proteolipids
- Biglycan

Inhibitors

- Large proteoglycans
- Pyrophosphate
- Adenosine triphosphate
- Citrate

Mineral proliferation

Regulators

- Osteocalcin
- Phosphoproteins
- Proteoglycans

Correct Answer: Matrix vesicles

646. (779) Q2-1040:

Which of the following can be an inhibitor of physiologic calcification in bone:

1) Type I collagen
3) Matrix vesicles
2) Large proteoglycans
5) Bone sialoprotein
4) Phosphoproteins

Large proteoglycans, pyrophosphate, adenosine triphosphate, and citrate all act as inhibitors of physiologic calcification of bone.

Note the role of promoters and inhibitors:

Apatite nucleation and growth

Promoters

- Type I collagen
- Bone sialoprotein
- Matrix vesicles
- Phosphoproteins
- Proteolipids
- Biglycan

Inhibitors

- Large proteoglycans
- Pyrophosphate
- Adenosine triphosphate
- Citrate

Mineral proliferation

Regulators

- Osteocalcin
- Phosphoproteins
- Proteoglycans

Correct Answer: Large proteoglycans

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647. (780) Q2-1041:

Cortical bone remodeling in a healthy older adult is typically:

1) 20%
3) 50%
2) 30%
5) 10%
4) 2% to 5%

Cortical bone remodeling can be as high as 50% in the femoral diaphysis during the first 2 years of life. *In older adults, the cortical remodeling rate is only 2% to 5% per year*. Trabecular bone remodels at a rate 5 to 10 times higher than cortical bone.

Correct Answer: 2% to 5%

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648. (781) Q2-1042:

The periosteal vessels supply what portion of the cortical bone blood circulation:

1) 5% to 10% of the inner endosteal surface
3) 1% to 5% of the outer periosteal surface
2) 10% to 20% of the inner endosteal surface
5) 30% to 50% of the outer periosteal surface
4) 15% to 20% of the outer periosteal surface

The periosteal vessels supply 15% to 20% of the outer periosteal surface.

There are three defined blood supplies:

- Nutrient vessel entering in the diaphysis
- Metaphyseal vessels from the periarticular vessels (geniculate vessels)
- Periosteal vessels supply the outer 15% to 20% of the cortex

Correct Answer: 15% to 20% of the outer periosteal surface

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649. (782) Q2-1043:

Human calcium absorption occurs in the

1) Stomach
3) Large intestine
2) Small intestine
5) Parathyroid glands
4) Liver

Dietary calcium is absorbed in the small intestine. This absorption is stimulated by 1,25 dihydroxyvitamin D3.

Correct Answer: Small intestine

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650. (783) Q2-1044:

Approximately how many hours of sunlight are necessary to produce the daily requirement of 400 units of vitamin D in white people:

1) 1 hour
3) 4 hour
2) 2 hour
5) 81 hour
4) 6 hour

One hour of sunlight per day is necessary in white people to convert 7-dehydrocholesterol to vitamin D3 (cholecalciferol). A longer exposure is necessary in dark-skinned people.

Correct Answer: 1 hour

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651. (784) Q2-1045:

Hydroxylation of vitamin D to 25-hydroxyvitamin D occurs in the:

1) Liver
3) Thyroid
2) Kidney
5) Small intestine
4) Parathyroid hormone

Vitamin D is hydroxylated to 25-hydroxyvitamin D in the liver. The vitamin is further hydroxylated to 1,25 dihydroxyvitamin D in the mitochondria of the proximal tubules of the kidney.

Correct Answer: Liver

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652. (785) Q2-1046:

Which of the following serum levels is the best indicator of body stores of vitamin D3:

1) 7-dehydrocholesterol
3) 25 hydroxyvitamin D3
2) 1,25 dihydroxyvitamin D3
5) Parathyroid hormone levels
4) 24,25 dihydroxyvitamin D3

A serum 25 hydroxyvitamin D3 level is the best indicator of body stores of vitamin D3.

Remember that 1,25 dihydroxyvitamin D3 is the active metabolite and 24,25 dihydroxyvitamin D3 is the inactive form.Correct Answer: 25 hydroxyvitamin D3

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653. (786) Q2-1047:

At which of the following sites is 25 hydroxyvitamin D3 converted into the active hormone 1,25 dihydroxyvitamin D3:

1) Skin
3) Kidney
2) Liver
5) Small intestine
4) Parathyroid hormone

Vitamin D3 is converted into its active form in the proximal tubules of the kidney. The active form is 1,25 dihydroxyvitamin D3.

Remember that the liver performs the conversion to 25 hydroxyvitamin D3 and the kidney further hydroxylates to 1,25 dihydroxyvitamin D3.

Correct Answer: Kidney

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654. (787) Q2-1048:

Which of the following causes the conversion of 1,25 dihydroxyvitamin D3 into the inactive metabolite 24,25 dihydroxyvitamin D3:

1) Ultraviolet light
3) Liver 1 alpha-hydroxylase
2) Enzymes in the mitochondria of the kidney proximal tubules
5) Decreased serum calcium level
4) Decreased serum parathyroid hormone

Increased serum calcium, increased serum phosphate level, and decreased parathyroid hormone all convert vitamin D to its inactive from â 24,25 dihydroxyvitamin D3.

Elevated serum parathyroid hormone and decreased calcium and phosphorus levels will increase conversion to the active form â 1,25 dihydroxyvitamin D3.

Correct Answer: Decreased serum parathyroid hormone

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655. (788) Q2-1049:

The daily elemental calcium requirement for a postmenopausal woman is:

1) 500 mg to 700 mg
3) 1,300 mg
2) 750 mg
5) 2,000 mg
4) 1,500 mg

The guidelines for the daily elemental calcium requirement are as follows:

Children	500 mg to 700 mg
Growth spurt to young adult (10 to 25 years of age)	1,300 mg
Adult male	750 mg
Adult female	Â Â Â
Postmenopausal	1,500 mg
Elderly	1,200 mg
Pregnancy	1,500 mg
Lactation	2,000 mg

Note: 1 daily equivalent = 250 mg elemental calcium (one glass of milk)
Correct Answer: 1,500 mg

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656. (789) Q2-1050:

The daily elemental calcium requirement for an elderly woman is:

1) 500 mg to 700 mg
3) 1,500 mg
2) 1,200 mg
5) 2,500 mg
4) 2,000 mg

The guidelines for the daily elemental calcium requirement are as follows:

Children	500 mg to 700 mg
Growth spurt to young adult (10 to 25 years of age)	1,300 mg
Adult male	750 mg
Adult female	Â Â Â
Postmenopausal	1,500 mg
Elderly	1,200 mg
Pregnancy	1,500 mg
Lactation	2,000 mg

Note: 1 daily equivalent = 250 mg elemental calcium (one glass of milk)
Correct Answer: 1,200 mg

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657. (790) Q2-1051:

The daily elemental calcium requirement for a pregnant woman is:

1) 500 mg to 700 mg
3) 1,500 mg
2) 1,200 mg
5) 2,500 mg
4) 2,000 mg

The guidelines for the daily elemental calcium requirement are as follows:

Children	500 mg to 700 mg
Growth spurt to young adult (10 to 25 years of age)	1,300 mg
Adult male	750 mg
Adult female	Â Â Â
Postmenopausal	1,500 mg
Elderly	1,200 mg
Pregnancy	1,500 mg
Lactation	2,000 mg

Note: 1 daily equivalent = 250 mg elemental calcium (one glass of milk)
Correct Answer: 1,500 mg

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658. (791) Q2-1052:

The daily elemental calcium requirement for a lactating woman is:

1) 500 mg to 700 mg
3) 1,200 mg
2) 750 mg
5) 2,000 mg
4) 1,500 mg

The guidelines for the daily elemental calcium requirement are as follows:

Children	500 mg to 700 mg
Growth spurt to young adult (10 to 25 years of age)	1,300 mg
Adult male	750 mg
Adult female	Â Â Â
Postmenopausal	1,500 mg
Elderly	1,200 mg
Pregnancy	1,500 mg
Lactation	2,000 mg

Note: 1 daily equivalent = 250 mg elemental calcium (one glass of milk)
Correct Answer: 2,000 mg

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659. (792) Q2-1053:

The active form of vitamin D has which of the following effects on end organs:

1) Vitamin D strongly stimulates intestinal absorption of calcium and phosphorus.
3) Vitamin D stimulates renal mitochondria to hydroxylate 25 hydroxyvitamin D.
2) Vitamin D inhibits osteoclastic resorption of bone.
5) Vitamin D promotes urinary excretion of phosphorus.
4) Vitamin D increases renal fractional resorption of filtered calcium.

Parathyroid hormone, 1,25 dihydroxyvitamin D, and calcitonin have the following effects on end organs:

Parathyroid hormone

Kidney

1. Stimulates 1,25 dihydroxyvitamin D formation
2. Increases fractional resorption of filtered calcium
3. Promotes urinary excretion of phosphorus

Bone

1. Stimulates osteoclast resorption of bone

1,25 dihydroxyvitamin D

Intestine

1. Stimulates small intestine absorption of calcium and phosphorus

Calcitonin

Bone

1. Inhibits osteoclastic resorption of bone

Correct Answer: Vitamin D strongly stimulates intestinal absorption of calcium and phosphorus.

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660. (793) Q2-1054:

The net effect of increased parathyroid hormone action on calcium and phosphorus concentration in the extracellular fluid and serum is:

1) Increased calcium, increased phosphate
3) Decreased calcium, decreased phosphate
2) Increased calcium, decreased phosphate
5) Transient decrease in serum calcium
4) Increased calcium, no effect on phosphate

Parathyroid hormone, the active form of vitamin D (1,25 dihydroxyvitamin D), and calcitonin each have a net effect on calcium and phosphorus concentrations in extracellular fluid and serum:

Net Effect

Parathyroid hormone	Increased serum calcium Decreased serum phosphate
Vitamin D3 (1,25 dihydroxyvitamin D)	Increased serum calcium Increased serum phosphate
Calcitonin	Decreased serum calcium (transient)

Correct Answer: Increased calcium, decreased phosphate

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661. (794) Q2-1055:

The net effect of 1,25 dihydroxyvitamin D3 on the calcium and phosphate concentration of the extracellular fluid and serum is:

1) Increased calcium, increased phosphate
3) Decreased calcium, decreased phosphate
2) Increased calcium, decreased phosphate
5) Transient decrease in serum calcium
4) Increased calcium, no effect on phosphate

Parathyroid hormone, the active form of vitamin D (1,25 dihydroxyvitamin D), and calcitonin each have a net effect on calcium and phosphorus concentrations in extracellular fluid and serum:

Net Effect

Parathyroid hormone	Increased serum calcium Decreased serum phosphate
Vitamin D3 (1,25 dihydroxyvitamin D)	Increased serum calcium Increased serum phosphate
Calcitonin	Decreased serum calcium (transient)

Correct Answer: Increased calcium, increased phosphate

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662. (795) Q2-1056:

The net effect of calcitonin on the calcium and phosphorus concentrations in the extracellular fluid and serum is:

1) Increased calcium, increased phosphate
3) Decreased calcium
2) Increased calcium, decreased phosphate
5) Transient decrease in serum calcium
4) Increased calcium, no effect on phosphate

Parathyroid hormone, the active form of vitamin D (1,25 dihydroxyvitamin D), and calcitonin each have a net effect on calcium and phosphorus concentrations in extracellular fluid and serum:

Net Effect

Parathyroid hormone	Increased serum calcium Decreased serum phosphate
Vitamin D3 (1,25 dihydroxyvitamin D)	Increased serum calcium Increased serum phosphate
Calcitonin	Decreased serum calcium (transient)

Correct Answer: Decreased calcium

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663. (861) Q2-1124:

In which of the following osteonecrotic conditions does the marrow cavity become packed with abnormal cells:

1) Caisson disease
3) Renal transplantation
2) Gaucher disease
5) Chronic corticosteroid administration
4) Pancreatitis

There are two conditions that cause osteonecrosis secondary to the marrow cavity becoming packed with abnormal cells â Gaucher disease and sickle cell disease. There is probable occlusion of the intraosseous arteries with both of these conditions.

With Gaucher disease, the marrow cavity is filled with Gaucher cells (macrophages filled with cerebroside). In sickle cell disease, the marrow cavity is filled with sickled red blood cells.

Correct Answer: Gaucher disease

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664. (862) Q2-1125:

Which of the following cells die in osteonecrosis:

1) Osteocytes only
3) Osteoblasts, osteocytes, hematopoietic cells, capillary endothelial cells, and lipocytes
2) Osteoblasts and osteocytes only
5) Osteoblasts only
4) Osteoblasts and osteoclasts only

There is complete death of all the elements inside the bone in osteonecrosis: osteoblasts, osteocytes, hematopoietic cells, capillary endothelial cells, and lipocytes.

In animal models, there are no histologic changes after the first week, but during the second week, there is evidence of death of all marrow cells. The osteocytes shrink and the lacunae are empty. The fat in the marrow dies and there is release of lysosomes. The pH is lower and the released calcium forms an insoluble soap with the saponified free fatty acids.

Correct Answer: Osteoblasts, osteocytes, hematopoietic cells, capillary endothelial cells, and lipocytes

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665. (863) Q2-1126:

The increased radiographic bone density in osteonecrosis is most likely secondary to:

1) Calcification of the necrotic bone marrow
3) Creeping substitution on the dead trabeculae
2) Insoluble soap from released calcium and free fatty acids
5) Necrotic cortical bone
4) Resorption of the Haversian canal bone

The majority of the increased radiographic bone density in osteonecrosis is caused by new bone formation laid down on the necrotic bone trabeculae. This occurs through the process of creeping substitution.

There is calcification of the necrotic marrow and insoluble soap formation from the combination of the free fatty acids and released calcium. However, this does not cause the majority of the increased radiodensity.

There is resorption of the Haversian canal bone, but this results in decreased radiodensity on the radiograph rather than increased radiodensity.

Necrotic bone that has not gone through the repair process appears normal on the plain radiograph (neither bone resorption or creeping substitution has occurred).

Correct Answer: Creeping substitution on the dead trabeculae

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666. (864) Q2-1127:

A 20-year-old college student sustains a closed distal one-third tibia fracture when he falls while skiing. Which of the following would be the most common fracture pattern and mechanism:

1) Short spiral fracture â torsion
3) Transverse fracture â pure bending
2) Oblique fracture â uneven bending
5) Segmental fracture â four-point bending
4) Oblique fracture with a butterfly fragment â bending and compression

This college student has sustained a low-energy twisting injury, also known as a boot-top injury. The fracture pattern is a short spiral fracture and the mechanism of injury is torsion loading of the tibia.

The other patterns included:

- Oblique fracture â uneven bending: This type of injury typically occurs following motorcycle accidents when the tibia is subjected to uneven bending forces.
- Transverse fracture â pure bending: This fracture is typical of a soccer injury because the tibia is subjected to pure bending forces.
- Oblique fracture with a butterfly fragment â bending and compression: This is a common fracture that occurs with low- and high-speed injuries. These fractures may occur from car bumpers and motorcycles.
- Segmental fracture â four-point bending: This pattern is typical of high-energy injury, such as a pedestrian being struck by a car bumper.

Correct Answer: Short spiral fracture â torsion

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667. (865) Q2-1128:

A 45-year-old man is struck by the bumper of a fast moving car. He has an open tibia fracture. Which of the following would be the most common fracture pattern and mechanism:

1) Short spiral fracture â torsion
3) Transverse fracture â pure bending
2) Oblique fracture â uneven bending
5) Segmental fracture â four-point bending
4) Oblique fracture with a butterfly fragment â bending and compression

The mechanism in this patient is four-point bending. A segmental fracture is common.

The other patterns included:

- Oblique fracture â uneven bending: This type of injury typically occurs following motorcycle accidents when the tibia is subjected to uneven bending forces.
- Transverse fracture â pure bending: This fracture is typical of a soccer injury because the tibia is subjected to pure bending forces.
- Oblique fracture with a butterfly fragment â bending and compression: This is a common fracture that occurs with low- and high-speed injuries. These fractures may occur from car bumpers and motorcycles.
- Short spiral fracture â torsion: This mechanism is usually from a low velocity skiing injury.

Correct Answer: Segmental fracture â four-point bending

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668. (866) Q2-1129:

A 25-year-old soccer player sustained a closed tibia fracture when his planted leg was struck by another player. Which of the following would be the most common fracture pattern and mechanism:

1) Short spiral fracture â torsion
3) Transverse fracture â pure bending
2) Oblique fracture â uneven bending
5) Segmental fracture â four-point bending
4) Oblique fracture with a butterfly fragment â bending and compression

A transverse fracture is secondary to a pure bending force.

The other patterns included:

- Oblique fracture â uneven bending: This type of injury typically occurs following motorcycle accidents when the tibia is subjected to uneven bending forces.
- Segmental fracture â four-point bending: This injury most commonly follows a high-energy injury, such as a pedestrian being struck by a car bumper.
- Oblique fracture with a butterfly fragment â bending and compression: This is a common fracture that occurs with low- and high-speed injuries. These fractures may occur from car bumpers and motorcycles.
- Short spiral fracture â torsion: This mechanism is usually from a low velocity skiing injury.

Correct Answer: Transverse fracture â pure bending

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669. (867) Q2-1130:

Which of the following would be a high-energy injury:

1) Transverse tibia fracture after a soccer injury
3) Femur fracture from a bullet with a 1,200 ft/sec muzzle velocity
2) Ulna shaft fracture secondary to being struck by a bat
5) Short spiral tibia fracture after a skiing injury
4) Segmental fracture from a car bumper

An injury caused by a car bumper is a high-energy injury.

All of the other distracters are low-energy injuries. Note that the cutoff for muzzle velocity between low- and high-energy injuries is 2,000 to 2,500 ft/sec.

Correct Answer: Segmental fracture from a car bumper

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670. (868) Q2-1131:

Which of the following is a high-energy injury:

1) Comminuted distal radius fracture after a fall on an outstretched hand
3) Humerus fracture from a bullet with a 2,900 ft/sec muzzle velocity
2) Comminuted radial head fracture after a fall
5) Transverse tibia fracture after a soccer injury
4) Ulna shaft fracture from a bat

Gun shot injuries with a muzzle velocity greater than 2,500 ft/sec are high-energy injuries. These injuries cause cavitation in the soft tissues. Often the projectiles yaw, increasing the amount of soft tissue damage. High-velocity injuries require aggressive debridement. Low-velocity projectiles have a muzzle velocity that is less than 1,500 ft/sec. There is minimal soft tissue damage such that debridement of the wound edge is all that is required.

Correct Answer: Humerus fracture from a bullet with a 2,900 ft/sec muzzle velocity

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671. (869) Q2-1132:

In which of the following fractures is the load to failure the lowest:

1) Transverse tibia fracture after a soccer collision
3) A short spiral humerus fracture after throwing a baseball from home to second base
2) Segmental tibia fracture after an automobile-pedestrian accident
5) A humerus fracture from a bullet with a muzzle velocity of 2,700 ft/sec
4) A comminuted spiral tibia fracture after a skiing injury

The lowest load to failure in long bones occurs with pure torsional forces. A long bone is weakest when loaded in pure torsion. Throwing may cause a humerus fracture through pure torsional loading. The skiing injury is also a torsional injury, however, the comminution indicates a greater amount of energy storage by the bone prior to failure.

Correct Answer: A short spiral humerus fracture after throwing a baseball from home to second base

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672. (870) Q2-1133:

A hematoma located at a bone fracture site forms a:

1) Fibrin scaffold formation for mechanical stability
3) Production of matrix vesicles to initiate mineralization
2) Source of signaling molecules, such as interleukins 1 and 6
5) Source of matrix vessels for protease and phosphatase production
4) Source of perivascular cells as progenitors of osteoblasts

The hematoma at a bone fracture site is believed to serve as a source of signaling molecules to control cellular events. Inflammatory cells produce cytokines, such as interleukin 1 and 6, and platelets in the clot release transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF).

An old theory was that the hematoma served as a fibrin scaffold and added mechanical stability.

The hypertrophied chondrocytes produce matrix vesicles that control mineralization. The hypertrophic cartilage cells are invaded by blood vessels that bring in the perivascular cells, which are the progenitors of the osteoblasts.

Correct Answer: Source of signaling molecules, such as interleukins 1 and 6

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673. (871) Q2-1134:

Which of the following fractures occurs through a single application of force:

1) A minimally displaced femoral neck fracture in a long distance runner
3) A fifth rib fracture in a collegiate rower
2) A second metatarsal fracture in a Naval Academy midshipman
5) A proximal one-third posterior tibial cortex fracture in a long distance runner
4) A short spiral humerus fracture in a baseball catcher

The femoral neck fracture, metatarsal fracture, rib fracture, and the tibial fracture are stress fractures that result from repetitive loading.

In contrast, the humeral fracture in the baseball catcher is secondary to failure of the humerus secondary to a pure torsional force. Long bones are at their weakest when loaded in pure torsion.

Correct Answer: A short spiral humerus fracture in a baseball catcher

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674. (872) Q2-1135:

Which of the following statements is true concerning the vascularity at a fracture site:

1) Periosteal blood vessels are capable of supplying the endosteal region.
3) Reamed intramedullary rods do not significantly interrupt endosteal blood supply.
2) Fracture site blood flow peaks at 2 weeks.
5) In animal studies, blood flow is greater at 42 days in rodded vs. plated tibias.
4) In animal studies, blood flow is greater at 120 days in plated vs. rodded tibias.

In the normal long bone, the periosteal vessels supply the outer one-third of the cortex. The nutrient artery enters at the diaphysis of a long bone and has ascending and descending vessels that supply the inner two-thirds of the cortex.

Important points to remember:

- The periosteal blood supply cannot supply the inner two-thirds of the cortex even if the endosteal blood supply has been interrupted, as in intramedullary reaming.
- Blood flow markedly drops at the fracture site at the time of the fracture and peaks at 2 weeks.
- Intramedullary reamed rods destroy the endosteal blood supply. In dog experiments, the blood supply is reconstituted to normal in 120 days.
- In dog experiments, the blood supply is decreased in both plated and rodded tibias at 42 and 90 days. The decrease is greater in the rodded tibias.
- The oxygen tension is low in the fracture hematoma and in the newly formed cartilage and bone. The oxygen tension is highest in the fibrous tissue. The hypoxic state favors cartilage formation.

Correct Answer: Fracture site blood flow peaks at 2 weeks.

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675. (873) Q2-1137:

Which of the following statements is true concerning molecular events at the site of a healing fracture:

1) Type II collagen production is lowest during the first 2 weeks.
3) Periosteal type III collagen serves as a substrate for migration of osteoprogenitor cells and capillary ingrowth.
2) Type I collagen production is highest during the first 2 weeks.
5) Types V and XI collagen control the maturation of mineralization crystals.
4) Type IX collagen initiates mineralization of type II collagen.

Important points to remember concerning molecular events at the fracture site:

- Type II collagen production is highest during the first 2 weeks. Cartilage is the first tissue produced at the fracture site. The chondrocytes hypertrophy and release matrix vesicles that prepare the extracellular matrix for mineralization of the cartilage. Blood vessels grow into the hypertrophied cartilage cells and perivascular cells become osteoblasts and begin mineralization. This is the exact same process that occurs at the growth plate with formation of the primary and secondary spongiosa.
- Type I collagen production is low during the first 2 weeks as cartilage is initially formed. Type I collagen production is highest as the cartilage is mineralized later.
- Periosteal type III collagen serves as a substrate for the migration of osteoprogenitor cells and capillary ingrowth.
- Type IX collagen contributes to the mechanical stability of type II collagen.
- Types V and XI collagen regulate the growth and orientation of types I and II collagen fibrils.

Correct Answer: Periosteal type III collagen serves as a substrate for migration of osteoprogenitor cells and capillary ingrowth.

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676. (874) Q2-1138:

Which of the following statements is true concerning the molecular events involved in fracture healing:

1) Osteonectin plays a role in early ossification.
3) Osteopontin plays no role in normal bone remodeling.
2) Osteocalcin inhibits intramembranous bone formation.
5) Osteonectin is found in proliferating and hypertrophic chondrocytes rather than extracellular matrix.
4) Fibronectin inhibits cell migration and adhesion.

There are several noncollagenous proteins that are important in bone repair and regeneration:

- Osteonectin â The gene for osteonectin is expressed at the onset of both intramembranous and enchondral ossification. It may play a role in the regulation of cell function in the early stages of ossification.
- Osteocalcin â Osteocalcin is expressed in the fracture callus only by osteoblastic cells. This protein may have a role in intramembranous subperiosteal bone formation.
- Osteopontin â This protein is found in the extracellular matrix and is important in cellular attachment. It is found in osteocytes and osteoprogenitor cells. Osteopontin may play a role in bone remodeling.
- Fibronectin â This protein plays a role in early fracture healing and is found in the fracture hematoma within 3 days. Fibronectin mediates adhesion and migration. It is found in the fibrous portions of provisional matrices and in cartilage matrix. The potential role for this protein is the establishment of provisional fibers in cartilaginous matrices.

Correct Answer: Osteonectin plays a role in early ossification.

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677. (933) Q2-1220:

Which of the following is *not* a clinical sign of rickets?

1) Irritability
3) Localized bone pain
2) Frontal bossing
5) Enlarged epiphyses
4) Short stature

Localized bone pain is not a common finding in rickets. In contrast, in osteomalacia, bone pain is very common. The features of rickets that one should remember include:

* Apathy

* Irritability

* Short stature

* Positive Gowers sign

* Laxity

* Frontal bossing

* Rachitic rosary, Harrisonâs groove enlarged physes

Correct Answer: Localized bone pain

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678. (934) Q2-1221:

Which of the following clinical findings are not associated with hyperparathyroidism:

1) Bone pain
3) Pathologic fractures
2) Brown tumors
5) Tetany
4) Renal stones

Features of primary hyperparathyroidism include bone pain, brown tumors, pathologic fractures, and kidney stones. Tetany is not a finding.

Here are some common features to remember:

- Common, incidence 1 in 500-1,000
- Females (usually postmenopausal) greater than men, 3:1
- Etiology
    - Benign, solitary adenoma (80%)
    - Four gland parathyroid hyperplasia
    - Parathyroid carcinoma (<0.5%)
- Osteitis fibrosa cystica
    - Subperiosteal resorption of distal phalanx
    - Tapering of distal clavicle
    - Bone cysts
    - Brown tumors
- Kidney stones
- Peptic ulcer disease and pancreatitis
- Biochemical hallmarks
    - Hypercalcemia
    - Elevated PTH (phosphorus lower range of normal, 1/3 low)
- Neuromuscular syndrome
    - Easy fatigue, weakness, older than you seem

Bone mineral density - excellent marker of the disease - low in distal radius (cortical bone) and normal at vertebra (cancellous bone)

Treatment - neck exploration and removal of the parathyroid adenoma

Correct Answer: Tetany

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679. (935) Q2-1222:

Which of the following is the most likely origin for the greater medullary artery (Adamkiewicz artery):

1) Lower cervical segmental
3) Middle thoracic segmental
2) Upper thoracic segmental
5) Upper lumbar segmental
4) Lower thoracic segmental

The major part of the blood supply of the spinal cord is provided by the medullary or radicular arteries. The only feeder for the lower thoracic spine cord is the greater medullary artery or artery of Adamkiewicz (T9-T11).

One should remember that in the thoracic spine the right-sided approach is preferred to avoid the aorta and segmental artery of Adamkiewicz.

Correct Answer: Lower thoracic segmental

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680. (936) Q2-1223:

The principle blood supply to the humeral head derives from:

1) The anterior humeral circumflex artery
3) The posterior humeral circumflex artery
2) Axillary artery
5) Subscapular artery
4) Acromial branch of thoracoacromial artery

The humeral head has been shown to be perfused primarily by the anterolateral ascending branch of the anterior circumflex artery. This branch runs parallel to the lateral aspect of the tendon of the long head of the biceps and enters the humeral head where the proximal end of the intertubercular groove meets the greater tuberosity. The posterior circumflex artery provides only the posterior portion of the greater tuberosity and a small posteroinferior part of the head.Correct Answer: The anterior humeral circumflex artery

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681. (937) Q2-1225:

A 4-year-old child injures his elbow and presents with swelling and limitation of voluntary movement. The radiographs show no obvious fracture, but it does show a Baumann angle of 71Â° and an elevation of the posterior fat pad. You tell the parents that this most likely represents:

1) A congenital anomaly with a valgus deformity of the elbow
3) A Salter I physeal separation
2) A medial epicondyle fracture
5) A variation of normal
4) An occult supracondylar fracture

Occult supracondylar fracture was the most common diagnosis assigned after careful study of a clinical series of elevated pediatric posterior fat pads.

- The value for Baumann angle is normally 73Â° Â± 6Â°. Nothing in this description suggests a congenital anomaly.
- Medial epicondyle fractures are extremely rare before 9 years of age.
- Although a Salter I physeal separation is a possibility, it is a rare injury.
- With an elevation of the posterior fat pad, there is increasing recognition that a fracture exists.

Correct Answer: An occult supracondylar fracture

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682. (1049) Q2-1356:

The tibialis anterior muscle is principally innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The tibialis anterior muscle is primarily innervated by the L4 nerve root. The tibialis anterior muscle also receives innervation from the L5 nerve root. Patients with a weak or absent tibialis anterior muscle will have a drop foot or a steppage gait. The tibialis anterior muscle causes dorsiflexion and inversion of the foot and ankle.Correct Answer: L4

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683. (1050) Q2-1357:

The patellar tendon reflex is primarily transmitted through which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

Although the patellar tendon reflex is primarily transmitted through the L4 nerve root, the L2 and L3 nerve roots also contribute to the fibers. There is a weak reflex if the L4 nerve root is completely cut, even if there are still L2 and L3 fibers. Patellar tendon reflex is seldom completely absent unless the patient has primary muscle or anterior horn lesions.Correct Answer: L4

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684. (1051) Q2-1358:

The skin on the medial aspect of the leg and great toe is innervated by which of the following nerve roots:

1) L2
3) L4
2) L3
5) S1
4) L5

It is important to remember the sensory dermatomes when examining patients. The medial aspect of the leg, foot, and great toe are supplied by the L4 nerve root. The tibial crest separates the L4 and L5 dermatomes on the leg.

Remember:

- L4 Medial aspect of the leg, foot, and great toe
- L5 Lateral aspect of the leg and toes 2 to 4
- S1 Lateral aspect of the fifth toe

Correct Answer: L4

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685. (1052) Q2-1359:

The extensor hallucis longus muscle is innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The extensor hallucis longus muscle is primarily innervated by the L5 nerve root.

The L5 nerve root innervates the following muscles:

- Extensor hallucis longus muscle
- Extensor digitorum longus and brevis muscles
- Gluteus medius muscle

Correct Answer: L5

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686. (1053) Q2-1360:

The extensor digitorum longus and brevis muscles are primarily innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The extensor digitorum longus and brevis muscles are primarily innervated by the L5 nerve root.

The L5 nerve root innervates the following muscles:

- Extensor hallucis longus muscle
- Extensor digitorum longus and brevis muscles
- Gluteus medius muscle

Correct Answer: L5

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687. (1054) Q2-1361:

The gluteus medius muscle is principally innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The gluteus medius muscle principally receives its innervation from the L5 nerve root through the superior gluteal nerve. Although the principal innervation is from L5, L4 and S1 nerve roots also contribute to the innervation.Correct Answer: L5

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688. (1055) Q2-1362:

Testing of the L5 nerve root is accomplished through the:

1) Patellar tendon reflex
3) Tibialis posterior reflex
2) Achilles tendon reflex
5) Beevor sign
4) Superficial anal reflex

There is not a well-defined reflex arc for the L5 nerve root. The tibialis posterior reflex may be elicited at times, and this reflex is mediated through the L5 nerve root.

Remember the other reflexes as well:

- Patellar tendon L4
- Achilles tendon S1
- Superficial anal reflex S2, S3, and S4

Beevor sign refers to asymmetry of the segmental innervation of the rectus abdominus muscles. This is noted when a patient performs a sit-up and unilateral segmental nerve root loss is noted.Correct Answer: Tibialis posterior reflex

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689. (1056) Q2-1363:

The skin on the lateral aspect of the leg and the dorsum of the foot between the second and fourth toes is innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The L5 dermatome covers the skin on the lateral leg and dorsum of the foot from the lateral border of the great toe to the medial border of the little toe.

Remember:

- L4 Medial aspect of the leg, foot, and great toe
- L5 Lateral aspect of the leg and toes 2 to 4
- S1 Lateral aspect of the fifth toe

Correct Answer: L5

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690. (1057) Q2-1364:

The peroneus longus and brevis muscles are innervated by which of the following nerve roots:

1) L3
3) L5
2) L4
5) S2
4) S1

The peroneus brevis and longus muscles are principally innervated by the S1 nerve root through the superficial peroneal nerve. Although the innervation is principally through the S1 nerve root, the nerve is derived from the L5 and S2 nerve roots, as well.

Remember that the muscles principally innervated by the S1 nerve root include:

- Peroneus longus and brevis muscles
- Gastrocnemius-soleus complex
- Gluteus maximus muscle

Correct Answer: S1

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691. (1058) Q2-1365:

The medial and lateral gastrocnemius muscles principally receive their innervation through which of the following nerve roots:

1) L3
3) L5
2) L4
5) S2
4) S1

The medial and lateral gastrocnemius muscles are principally supplied by the S1 nerve root through the tibial nerve. There are also nerve fiber contributions from L5 and S2.

Remember that the muscles principally innervated by the S1 nerve root include:

- Peroneus longus and brevis muscles
- Gastrocnemius-soleus complex
- Gluteus maximus muscle

Correct Answer: S1

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692. (1059) Q2-1366:

The Achilles tendon reflex (ankle reflex) is transmitted through which of the following nerve roots:

1) L4
3) S1
2) L5
5) S3
4) S2

The Achilles tendon reflex is based upon the triceps muscle group (medial and lateral gastrocnemius muscles and soleus muscle) and is transmitted through the S1 nerve root.

Remember:

- Patellar tendon reflex L4
- Posterior tibial reflex L5
- Achilles tendon reflex S1

Correct Answer: S1

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693. (1060) Q2-1367:

Which of the following groups of nerve roots innervate the intrinsic muscles of the foot:

1) L2, L3, and L4
3) L4, L5, and S1
2) L4 and L5
5) S2 and S3
4) L5, S1, and S2

The intrinsic muscles of the foot are innervated by the S2 and S3 nerve roots. These muscles are difficult to test. Clawing of the toes occurs with intrinsic muscle paralysis.

Remember the following nerve roots and the structures that they innervate:

- L5, S1 and S2 — Hip extension: Gluteus maximus muscle
- L5, S1, and S2 — Foot plantarflexion
- L5, S1 and S2 — Foot eversion
- L4, L5, and S1 — Hip abduction: Gluteus medius muscle
- L4, L5 — Foot dorsiflexion
- L4, L5 — Foot inversion
- L2, L3, and L4 — Hip adduction
- L2, L3, and L4 — Knee extension
- L1, L2, and L3 — Hip flexion: Iliopsoas muscle

Correct Answer: S2 and S3

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694. (1061) Q2-1368:

Perianal sensation is derived from which of the following nerve roots:

1) L2, L3, and L4
3) L5, S1, and S2
2) L3, L4, and L5
5) S2, S3, S4, and S5
4) S1, S2, and S3

Perianal sensation is derived from the S2, S3, S4, and S5 nerve roots.

The sensory distribution is as follows:

- S4-S5 — Innermost perianal ring
- S3 — Middle perianal ring
- S2 — Outermost perianal ring

Correct Answer: S2, S3, S4, and S5

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695. (1062) Q2-1369:

Which of the following sensory segmental levels corresponds with the nipple line:

1) T2
3) T7
2) T4
5) T12
4) T10

It is important to know the sensory segmental levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, a clinician should also know the sensory levels.

Remember:

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T4

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696. (1063) Q2-1370:

Which of the following sensory segmental levels corresponds to sensation at the xiphoid process:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin over the xiphoid process area is innervated by the T7 nerve root.

It is important to know the sensory segmental levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, a clinician should also know the sensory levels.

Remember:

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T7

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697. (1064) Q2-1371:

The skin over the umbilicus is innervated by which of the following sensory segmental levels:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin of the umbilicus is innervated by the T10 sensory segmental level.

It is important to know the sensory segmental levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, a clinician should also know the sensory levels.

Remember:

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T10

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698. (1065) Q2-1372:

The skin over the groin is innervated by which of the following sensory segmental levels:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin over the groin is innervated by the T12 sensory segmental level.

It is important to know the sensory segmental levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, a clinician should also know the sensory levels.

Remember:

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T12

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699. (1066) Q2-1373:
Which of the following levels of the spinal cord principally innervates the main flexor of the hip:

1) T10, T11, and T12
3) L2, L3, and L4
2) L1, L2, and L3
5) L5, S1, and S2
4) L4, L5, and S1

The iliopsoas muscle is the main flexor of the hip, and it receives principal innervation from the L1, L2, and L3 levels.

Remember:

- L5, S1 and S2 Hip extension: Gluteus maximus muscle
- L5, S1, and S2 Foot plantarflexion
- L5, S1 and S2 Foot eversion
- L4, L5, and S1 Hip abduction: Gluteus medius muscle
- L4 and L5 Foot dorsiflexion
- L4 and L5 Foot inversion
- L2, L3, and L4 Hip adduction
- L2, L3, and L4 Knee extension
- L1, L2, and L3 Hip flexion: Iliopsoas muscle

Correct Answer: L1, L2, and L3

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700. (1067) Q2-1374:
Which of the following segmental levels innervates the quadriceps muscle:

1) T10, T11, and T12
3) L2, L3, and L4
2) L1, L2, and L3
5) L5, S1, and S2
4) L4, L5, and S1

The quadriceps muscle is innervated by the femoral nerve from the L2, L3, and L4 segmental levels.

Remember:

- â¢ L5, S1 and S2 Hip extension: Gluteus maximus muscle
- â¢ L5, S1, and S2 Foot plantarflexion
- â¢ L5, S1 and S2 Foot eversion
- â¢ L4, L5, and S1 Hip abduction: Gluteus medius muscle
- â¢ L4 and L5 Foot dorsiflexion
- â¢ L4 and L5 Foot inversion
- â¢ L2, L3, and L4 Hip adduction
- â¢ L2, L3, and L4 Knee extension
- â¢ L1, L2, and L3 Hip flexion: Iliopsoas muscle

Correct Answer: L2, L3, and L4

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701. (1068) Q2-1375:

The skin over the anterior distal thigh above the patella is innervated by which of the following sensory segmental levels:

1) T12
3) L2
2) L1
5) L4
4) L3

The skin over the thigh is innervated by the L1, L2, and L3 sensory segmental levels.

Remember:

- L1 Thigh, proximal third, and anterior
- L2 Thigh, middle, and anterior
- L3 Thigh, distal third, and anterior

Correct Answer: L3

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702. (1069) Q2-1376:

The skin of the anterior middle third of the thigh is innervated by which of the following sensory segmental levels:

1) T12
3) L2
2) L1
5) L4
4) L3

The skin over the thigh is innervated by the L1, L2, and L3 sensory segmental levels.

Remember:

- L1 Thigh, proximal third, and anterior
- L2 Thigh, middle, and anterior
- L3 Thigh, distal third, and anterior

Correct Answer: L2

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703. (1070) Q2-1377:

The skin of the proximal one-third of the anterior thigh just distal to the inguinal ligament is innervated by which of the following sensory segmental levels:

1) T12
3) L2
2) L1
5) L4
4) L3

The skin over the thigh is innervated by the L1, L2, and L3 sensory segmental levels.

Remember:

- â¢ L1 Thigh, proximal third, and anterior
- â¢ L2 Thigh, middle, and anterior
- â¢ L3 Thigh, distal third, and anterior

Correct Answer: L1

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704. (1243) Q2-1613:

The tibialis anterior muscle is principally innervated by which of the following segmental levels:

1) L1
3) L3
2) L2
5) L5
4) L4

The tibialis anterior muscle is primarily innervated by the L4 nerve root. The tibialis anterior muscle also receives innervation from L5. Patients with a weak or absent tibialis anterior muscle will have a drop foot or a steppage gait. The tibialis anterior muscle causes dorsiflexion and inversion of the foot and ankle.Correct Answer: L4

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705. (1244) Q2-1614:

The patellar tendon reflex is primarily transmitted through which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

Although the patellar tendon reflex is transmitted primarily through the L4 nerve root, the L2 and L3 nerve roots also contribute to the fibers. A weak reflex is present if the L4 nerve root is completely cut even if there are still fibers of L2 and L3. This reflex is seldom completely absent unless the patient has primary muscle or anterior horn lesions.Correct Answer: L4

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706. (1245) Q2-1615:

The skin on the medial aspect of the leg and great toe is innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

It is important to remember the sensory dermatomes when examining patients. The medial aspect of the leg, foot, and great toe are supplied by the L4 nerve root. The tibial crest separates the L4 and L5 dermatomes on the leg.

Note:

L4 Medial aspect of leg, foot, and great toe
L5 Lateral aspect of the leg and toes two through four
S1 Lateral aspect of the fifth toe

Correct Answer: L4

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707. (1246) Q2-1616:

The extensor hallucis longus muscle is innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The extensor hallucis muscle is primarily innervated by the L5 segmental level.

Remember that the L5 nerve root innervates the following muscles:

- Extensor hallucis longus
- Extensor digitorum longus and brevis
- Gluteus medius

Correct Answer: L5

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708. (1247) Q2-1617:

The extensor digitorum longus and brevis muscles are primarily innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The extensor digitorum longus and brevis muscles are primarily innervated by the L5 nerve root.

Remember that the L5 nerve root innervates the following muscles:

- Extensor hallucis longus
- Extensor digitorum longus and brevis
- Gluteus medius

Correct Answer: L5

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709. (1248) Q2-1618:

The gluteus medius muscle is principally innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The gluteus medius muscle principally receives innervation from the L5 nerve root through the superior gluteal nerve. Although the principal innervation is from L5, there are contributions from L4 and S1.Correct Answer: L5

---

710. (1249) Q2-1619:

Testing for the L5 nerve root can be accomplished through which of the following:

1) Patellar tendon reflex
3) Superficial anal reflex
2) Achilles tendon reflex
5) Beevor's sign
4) Tibialis posterior reflex

There is not a well-defined reflex arc for the L5 nerve root. The tibialis posterior reflex can sometimes be elicited, and this reflex is mediated through the L5 nerve root.

Remember the other reflexes as well:

Patellar tendon	L4
Achilles tendon	S1
Superficial anal reflex	S2, S3, S4

Beevorâs sign refers to asymmetry of the segmental innervation of the rectus abdominus muscles. When a patient performs a sit-up, there is unilateral segmental nerve root loss.Correct Answer: Tibialis posterior reflex

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711. (1250) Q2-1620:

The skin on the lateral aspect of the leg and the dorsum of the foot between the second and fourth toes is innervated by which of the following nerve roots:

1) L1
3) L3
2) L2
5) L5
4) L4

The L5 dermatome covers the skin on the lateral leg and dorsum of the foot from the lateral border of the great toe to the medial border of the little toe.

Note:

L4 Medial aspect of leg, foot, and great toe
L5 Lateral aspect of the leg and toes two through four
S1 Lateral aspect of the fifth toe

Correct Answer: L5

---

712. (1251) Q2-1621:

The peroneus longus and brevis muscles are innervated by which of the following nerve roots:

1) L3
3) L5
2) L4
5) S2
4) S1

The peroneus brevis and longus muscles are principally innervated by the S1 nerve root through the superficial peroneal nerve. Although the innervation is principally S1, the nerve is derived from the L5 and S2 nerve roots, as well.

Remember that the muscles principally innervated by the S1 nerve root are:

- Peroneus longus and brevis
- Gastrocnemius-soleus complex
- Gluteus maximus

Correct Answer: S1

---

713. (1252) Q2-1622:

The medial and lateral gastrocnemius muscles principally receive their innervation through which of the following nerve roots:

1) L3
3) L5
2) L4
5) S2
4) S1

The medial and lateral gastrocnemius muscles are principally supplied by the S1 nerve root through the tibial nerve. Although the innervation is principally S1, the nerve is derived from the L5 and S2 nerve roots, as well.

Remember that the muscles principally innervated by the S1 nerve root are:

- Peroneus longus and brevis
- Gastrocnemius-soleus complex
- Gluteus maximus

Correct Answer: S1

---

714. (1253) Q2-1623:

The Achilles tendon reflex (ankle reflex) is transmitted through which of the following nerve roots:

1) L4
3) S1
2) L5
5) S3
4) S2

The Achilles tendon reflex is based upon the triceps muscle group (medial and lateral gastrocnemius muscles and soleus muscle) and is transmitted through the S1 nerve root.

Note the reflexes and the associated nerve roots:

Patellar tendon reflex	L4
Posterior tibial reflex	L5
Achilles tendon reflex	S1

Correct Answer: S1

---

715. (1254) Q2-1624:

Which of the following groups of nerve roots innervates the intrinsic muscles of the foot:

1) L2, L3, and L4
3) L4, L5, and S1
2) L4 and L5
5) S2 and S3
4) L5, S1, and S2

The intrinsic muscles of the foot are innervated by the S2 and S3 nerve roots. These muscles are difficult to test. Clawing of the toes occurs with intrinsic muscle paralysis.

The following nerve roots innervate important structures:

L5, S1, and S2	Hip extension: gluteus maximus
L5, S1, and S2	Foot plantar flexion
L5, S1, and S2	Foot eversion
L4, L5, and S1	Hip abduction: gluteus medius
L4, L5	Foot dorsiflexion
L4, L5	Foot inversion
L2, L3, and L4	Hip adduction
L2, L3, and L4	Knee extension
L1, L2, and L3	Hip flexion: iliopsoas

Correct Answer: S2 and S3

---

716. (1255) Q2-1625:

Perianal sensation is derived from which of the following nerve roots:

1) L2, L3, and L4
3) L5, S1, and S2
2) L3, L4, and L5
5) S2, S3, S4, and S5
4) S1, S2, and S3

Perianal sensation is derived from the S2, S3, S4, and S5 nerve roots.

The sensory distribution is as follows:

S4-S5	Innermost perianal ring
S3	Middle perianal ring
S2	Outermost perianal ring

Correct Answer: S2, S3, S4, and S5

---

717. (1256) Q2-1626:

Which of the following sensory segmental levels corresponds with the nipple line:

1) T2
3) T7
2) T4
5) T12
4) T10

It is important to know the sensory levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels.

Note:

T4	Nipple line
T7	Xiphoid process
T10	Umbilicus
T12	Groin

Correct Answer: T4

---

718. (1257) Q2-1627:

Which of the following segmental nerve levels corresponds to sensation at the xiphoid process:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin over the xiphoid process area is innervated by the T7 nerve root.

It is important to know the sensory levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels.

Note:

T4	Nipple line
T7	Xiphoid process
T10	Umbilicus
T12	Groin

Correct Answer: T7

---

719. (1258) Q2-1628:

The skin over the umbilicus is innervated by which of the following levels:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin of the umbilicus is innervated by the T10 level.

It is important to know the sensory levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels.

Note:

T4	Nipple line
T7	Xiphoid process
T10	Umbilicus
T12	Groin

Correct Answer: T10

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720. (1259) Q2-1629:

The skin over the groin is innervated by which of the following segmental levels:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin over the groin is innervated by the T12 level.

It is important to know the sensory levels to localize pathologic processes. In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels.

Note:

T4	Nipple line
T7	Xiphoid process
T10	Umbilicus
T12	Groin

Correct Answer: T12

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721. (1260) Q2-1630:
Which of the following levels of the spinal cord principally innervates the main flexor of the hip:

1) T10, T11, T12
3) L2, L3, L4
2) L1, L2, L3
5) L5, S1, S2
4) L4, L5, S1

The iliopsoas muscle is the main flexor of the hip. The iliopsoas muscle receives innervation from the L1, L2, and L3 levels.

One should remember the following nerve roots that innervate important structures:

L5, S1, and S2	Hip extension: gluteus maximus
L5, S1, and S2	Foot plantar flexion
L5, S1, and S2	Foot eversion
L4, L5, and S1	Hip abduction: gluteus medius
L4, L5	Foot dorsiflexion
L4, L5	Foot inversion
L2, L3, and L4	Hip adduction
L2, L3, and L4	Knee extension
L1, L2, and L3	Hip flexion: iliopsoas

Correct Answer: L1, L2, L3

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722. (1261) Q2-1631:
Which of the following segmental levels innervates the quadriceps muscle:

1) T10, T11, T12
3) L2, L3, L4
2) L1, L2, L3
5) L5, S1, S2
4) L4, L5, S1

The quadriceps muscle is innervated by the femoral nerve from the L2, L3, and L4 levels.

One should remember the following nerve roots that innervate important structures:

L5, S1, and S2	Hip extension: gluteus maximus
L5, S1, and S2	Foot plantar flexion
L5, S1, and S2	Foot eversion
L4, L5, and S1	Hip abduction: gluteus medius
L4, L5	Foot dorsiflexion
L4, L5	Foot inversion
L2, L3, and L4	Hip adduction
L2, L3, and L4	Knee extension
L1, L2, and L3	Hip flexion: iliopsoas

Correct Answer: L2, L3, L4

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723. (1262) Q2-1632:
The skin over the anterior distal thigh above the patella is innervated by which of the following nerves:

1) T12
3) L2
2) L1
5) L4
4) L3

The skin over the thigh is innervated by L1, L2, and L3.

Note:

L1 Thigh, proximal third, anterior
L2 Thigh, middle, anterior
L3 Thigh, distal third, anterior
Correct Answer: L3

---

724. (1263) Q2-1633:
The skin of the anterior middle third of the thigh is innervated by which of the following levels:

1) T12
3) L2
2) L1
5) L4
4) L3

The skin over the anterior middle third of the thigh is innervated by L1, L2, and L3.

Note:

L1 Thigh, proximal third, anterior
L2 Thigh, middle, anterior
L3 Thigh, distal third, anterior
Correct Answer: L2

---

725. (1264) Q2-1634:
The skin of the proximal one-third of the anterior thigh just distal to the inguinal ligament is innervated by which of the following levels:

1) T12
3) L2
2) L1
5) L4
4) L3

The skin of the proximal one-third of the anterior thigh just distal to the inguinal ligament is innervated by L1, L2, and L3.

Note:

L1 Thigh, proximal third, anterior
L2 Thigh, middle, anterior
L3 Thigh, distal third, anterior
Correct Answer: L1

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726. (1265) Q2-1635:

The mechanism of action of the fluoroquinolone class of antibiotics, such as ciprofloxacin and gatifloxacin, is:

1) Inhibiting of cell wall synthesis
3) Inhibiting RNA synthesis
2) Selectively targeting bacterial topoisomerases (inhibit DNA replication)
5) Poisoning cytochrome C system
4) Inhibiting ribosomal translation

The fluoroquinolone class of antibiotics selectively target bacterial topoisomerases. Topoisomerases maintain the correct amount of supercoiling of DNA in both replicating and nonreplicating areas of the chromosomes.

Fluoroquinolones

Second generation

Ciprofloxacin, ofloxacin, and lomefloxacin

Third generation

Sparfloxacin and levofloxacin

Fourth generation

Trovofloxacin, gatifloxacin, and moxifloxacin

Correct Answer: Selectively targeting bacterial topoisomerases (inhibit DNA replication)

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727. (1266) Q2-1636:

The fluoroquinolone class of antibiotics, including ofloxacin and ciprofloxacin, is especially useful (considered drug of choice) for osteomyelitis caused by which of the following organisms:

1) *Pseudomonas*
3) *Staphylococcus epidermidis*
2) *Staphylococcus aureus*
5) *Streptococcus*
4) *Enterobacteriaceae*

Ofloxacin and ciprofloxacin have been studied in the treatment of post-traumatic osteomyelitis. When compared with parenteral antibiotics, the cure rate was 80% for the fluoroquinolones and 85% for the parenteral antibiotics. The cure rate for the fluoroquinolones was even higher against Enterobacteriaceae. They are considered the drug of choice for osteomyelitis according to the referenced article.Correct Answer: *Enterobacteriaceae*

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728. (1267) Q2-1637:

In which of the following groups of patients should fluoroquinolones such as ciprofloxacin not be used because of significant adverse effects:

1) Young women
3) Diabetic patients
2) Children
5) Patients with sickle cell anemia
4) Elderly patients

Fluoroquinolones may cause side effects to the musculoskeletal system that include arthralgias, chondrotoxicity, and tendinopathy.

Cartilage damage was found in animal studies at therapeutic doses. The cartilage cells of the physeal plate were damaged. Cartilage blistering, erosions, matrix degeneration, and chondrocyte loss were also present. The fluoroquinolones are not to be used in children, pregnant women, and nursing mothers unless under special circumstances (such as drug resistance in children with cystic fibrosis).

The fluoroquinolones are safe in the other groups of patients. One should remember the following:

- Light-headedness and dizziness may occur in young women.
- Nausea, vomiting, and diarrhea are the most common complications.
- Nonsteroidal anti-inflammatory drugs taken in combination will worsen side effects.
- Photosensitivity may occur.
- Achilles tendonitis and rupture may occur.

Correct Answer: Children

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729. (1268) Q2-1638:

Which of the following musculoskeletal complications may occur in patients taking fluoroquinolones, such as ciprofloxacin:

1) Osteomalacia
3) Joint laxity
2) Osteoporosis
5) Parethesias
4) Tendon ruptures

Fluoroquinolones may cause side effects to the musculoskeletal system that include arthralgias, chondrotoxicity, and tendinopathy.

Achilles tendonitis and rupture is the most common tendinopathy associated with fluoroquinolone use (usually ciprofloxacin). Fifty percent of cases are bilateral. The interval to rupture is between 2 and 60 days.

Patients at increased risk include:

- Patients older than 60 years of age
- Patients with diabetes
- Patients with impaired renal function
- Patients who partake in strenuous sports activities

Correct Answer: Tendon ruptures

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730. (1269) Q2-1639:

Which of the following proteins binds to osteoclast precursor cells and positively effects their final differentiation into osteoclasts:

1) Receptor activator of nuclear factor-kappa B (RANK)
3) Bone morphogenetic protein 7
2) Osteoprotegerin
5) Parathyroid hormone related protein (PTHrP)
4) Core binding factor alpha 1 (Cbfa1)

Four proteins that regulate osteoclast activation have been discovered:

1. Receptor activator of nuclear factor-kappa B (RANK) binds to a receptor on osteoclast precursor cells and positively effects their final differentiation into osteoclasts.
2. Osteoprotegerin is a soluble decoy receptor that resembles RANK and inhibits osteoclasts.
3. Tumor necrosis factor-related activation induced cytokine (TRANCE)
4. Osteoclast differentiation factor

Note:
Core binding factor alpha 1 (Cbfa1) is a transcription factor (coded by the Cbfa1 gene) that is necessary and sufficient for differentiation of cells into osteoblasts and facilitates chondrocyte differentiation during enchondral bone formation.Correct Answer: Receptor activator of nuclear factor-kappa B (RANK)

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731. (1270) Q2-1640:

Which of the following proteins negatively effects precursor cells to form osteoclasts:

1) Receptor activator of nuclear factor-kappa B (RANK)
3) Bone morphogenetic protein 7
2) Osteoprotegerin
5) Parathyroid hormone related protein (PTHrP)
4) Core binding factor alpha 1 (Cbfa1)

Four proteins that regulate osteoclast activation have been discovered:

1. Receptor activator of nuclear factor-kappa B (RANK) binds to a receptor on osteoclast precursor cells and positively effects their final differentiation into osteoclast activation.
2. Osteoprotegerin is a soluble decoy receptor that resembles RANK and inhibits osteoclasts.
3. Tumor necrosis factor-related activation induced cytokine (TRANCE)
4. Osteoclast differentiation factor

Note:
Core binding factor alpha 1 (Cbfa1) is a transcription factor (coded by the Cbfa1 gene) that is necessary and sufficient for differentiation of cells into osteoblasts and facilitates chondrocyte differentiation during enchondral bone formation.Correct Answer: Osteoprotegerin

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732. (1271) Q2-1641:

Which of the following proteins or genes is necessary for bone formation and induces osteocalcin (expressed exclusively by osteoblasts):

1) Sox-9 gene
3) Receptor activator of nuclear factor-kappa B (RANK)
2) Core binding factor alpha 1 (Cbfa1)
5) Osteoprotegerin
4) Tumor necrosis factor-related activation induced cytokine (TRANCE)

Core binding factor alpha 1 (Cbfa1) and its gene (Cbfa1) have been described as anabolic regulators of bone. Cbfa1 is a transcription factor and is responsible for the differentiation of precursor cells into osteoblasts. It also enhances differentiation of chondrocytes during enchondral bone formation. When there is deficiency of Cbfa1 there can be abnormal bone development, as in clediocranial dysplasia.Correct Answer: Core binding factor alpha 1 (Cbfa1)

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733. (1272) Q2-1642:

The human genome is comprised of approximately what number of genes:

1) 1,000
3) 10,000
2) 5,000
5) 100,000
4) 30,000

The human genome is composed of approximately 30,000 unique genes. Each gene is composed of a promotor or regulator region and a transcriptional or coding region. Regulatory proteins or transcription factors bind to the promoter region of the gene to signal the beginning of transcription of the DNA into RNA or repress the expression of the gene. The coding region contains both introns and exons. Exon sequences of the gene directly code for the proteins, and the introns are spacers. The intron sequences are enzymatically removed from the newly transcribed messenger RNA by a splicing mechanism.Correct Answer: 30,000

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734. (1273) Q2-1643:

Which of the following portions of a gene directly codes for the messenger RNA for eventual translation into proteins on the ribosome:

1) Promoter region
3) Exon
2) Intron
5) Activator or repressor binding site
4) Coding region

The human genome is composed of approximately 30,000 unique genes. Each gene is composed of a promotor or regulator region and a transcriptional or coding region. Regulatory proteins or transcription factors bind to the promoter region of the gene to signal the beginning of transcription of the DNA into RNA or repress the expression of the gene. The coding region contains both introns and exons. Exon sequences of the gene directly code for the proteins, and the introns are spacers. The intron sequences are enzymatically removed from the newly transcribed messenger RNA by a splicing mechanism.Correct Answer: Exon

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735. (1910) Q2-2320:

Which of the following occurs in Pagetâs disease:

1) Inadequate mineralization of newly formed bone
3) Normal osteoclastic activity with decreased osteoblastic activity
2) Low bone mass and microarchitectural deterioration of bone
5) Increased osteoclastic activity and increased bone formation
4) Increased osteoclastic activity and normal osteoblastic activity

Pagetâs disease is a remodeling disease in which there is marked bone resorption by the osteoclast. The osteoblasts repair the bone in a mosaic pattern with thickened trabeculae and cement or remodeling lines. There is both increased osteoclastic activity and increased bone formation by the osteoblast.

Inadequate mineralization of newly formed bone is called osteomalacia. In children, there is decreased mineralization at the growth plate.

Osteoporosis refers to low bone mass and microarchitectural deterioration of bone.
There are two types of osteoporosis:

- High turnover osteoporosis is increased osteoclastic activity and normal osteoblastic activity. In high turnover, the osteoclasts resorb large amounts of bone and the osteoblasts are unable to replace the bone. One finds markers for high levels of bone resorption and bone formation in the serum and the urine.
- Low turnover osteoporosis is normal osteoclastic activity with decreased osteoblastic activity. In low turnover, the osteoclastic activity is at the normal rate; however, there is insufficient osteoblastic activity to fill in the osteoclastic resorption cavities. The markers for osteoclastic resorption are normal and the markers for bone formation are decreased.

Correct Answer: Increased osteoclastic activity and increased bone formation

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736. (1911) Q2-2321:

Which of the following laboratory studies evaluates amounts of bone resorption:

1) Serum alkaline phosphatase
3) Gamma-glutamyl transpeptidase
2) Aspartate aminotransferase and alanine aminotransferase
5) Urine N-telopeptide, pyridinoline, and deoxypyridinoline
4) Osteocalcin

Bone resorption is assessed by measuring the products of bone remodeling. N-telopeptide, pyridinoline, and deoxypyridinoline are collagen cross-link products that are released during bone turnover. These collagen cross-links can be measured in the urine. A new marker can be measured in the serum and is called carboxy terminal collagen cross-links (CrossLaps).

Bone formation is assessed with serum alkaline phosphastase and osteocalcin.

Liver function tests include aspartate aminotransferase, alanine aminotransferase, and gamma-glutamyl transpeptidase.Correct Answer: Urine N-telopeptide, pyridinoline, and deoxypyridinoline

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737. (1912) Q2-2322:

Pagetâs disease is common in all of the following bones except:

1) Humerus
3) Femur
2) Spine
5) Pelvis
4) Hands and feet

Key features of Pagetâs disease:

- Remodeling disease caused by excessive osteoclastic activity
- Rarely diagnosed in patients younger than 40 years of age; most patients diagnosed after age 50
- Most common sites include pelvis, femur, spine, skull, and tibia
- Less common sites include clavicles, scapulae, ribs, and facial bones
- Rarely found in the hands and feet
- Pagetic bone
    - is more susceptible to fracture
    - is less compact
    - is more vascular
    - tends to bow in weight bearing areas
- Geographic clustering (up to 4% in patients older than 55 years of age)
    - England
    - Northern Europe
    - North America
    - Australia, New Zealand
    - Rare in Asia, China, Indonesia, Malaysia, and sub-Saharan Africa
- Possibly a slow viral disease
    - RNA paramyxovirus (e.g., respiratory syncytial virus and measles)

Correct Answer: Hands and feet

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738. (1913) Q2-2323:

Pagetâs disease is common in all of the listed locations except:

1) England
3) Northern Europe
2) United States
5) Sub-Saharan Africa
4) Australia

Key features of Pagetâs disease

- Remodeling disease caused by excessive osteoclastic activity
- Rarely diagnosed in patients younger than 40 years of age; most patients diagnosed after age 50
- Most common sites include pelvis, femur, spine, skull, and tibia
- Less common sites include clavicles, scapulae, ribs, and facial bones
- Rarely found in the hands and feet
- Pagetic bone
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    - is less compact
    - is more vascular
    - tends to bow in weight bearing areas
- Geographic clustering (up to 4% in patients older than 55 years of age)
    - England
    - Northern Europe
    - North America
    - Australia, New Zealand
    - Rare in Asia, China, Indonesia, Malaysia, and sub-Saharan Africa
- Possibly a slow viral disease
    - RNA paramyxovirus (e.g., respiratory syncytial virus and measles)

Correct Answer: Sub-Saharan Africa

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739. (1914) Q2-2324:

Which of the following occurs in active Pagetâs disease:

1) Intense osteoclastic activity, intense osteoblastic activity
3) Intense osteoclastic activity, decreased osteoblastic activity
2) Decreased osteoclastic activity, decreased osteoblastic activity
5) Intense osteoclastic activity, normal osteoblastic activity
4) Decreased osteoclastic activity, increased osteoblastic activity

Marked bone resorption by the osteoclast and marked bone formation by the osteoblast occurs in active Pagetâs disease. The activities of the osteoclast and osteoblast are linked together.Correct Answer: Intense osteoclastic activity, intense osteoblastic activity

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740. (1915) Q2-2325:

Osteocytic osteolysis refers to which of the following processes:

1) Loss of bone through decreased bone formation
3) Removal of bone by osteoclasts
2) Mobilization of poorly crystallized calcium salts without effect on bone matrix
5) Osteocyte-mediated resorption of bone matrix
4) Loss of bone by osteoclasts in multiple myeloma

Osteocytes do not directly resorb bone. Osteocytes have receptors for parathyroid hormone, and they mobilize poorly crystallized calcium salts that surround them without resorbing the bone matrix. The osteocytes connect with each other through long, thin cytoplasmic processes.Correct Answer: Mobilization of poorly crystallized calcium salts without effect on bone matrix

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741. (1916) Q2-2326:

Which of the following cells sends mechanical signals and transmits messages to other cells to increase bone remodeling in areas of maximum stress and strain:

1) Mast cells in bone marrow
3) Plasma cells
2) Osteoblasts
5) Osteocytes
4) Osteoclasts

Osteocytes respond to mechanical signals and transmit messages to other cells to increase bone remodeling.Correct Answer: Osteocytes

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742. (1917) Q2-2327:

Receptor activator of nuclear factor â*k*B (RANK) is located on which of the following cells:

1) Osteoblasts
3) Osteocytes
2) Plasma cells
5) Osteoclast precursors
4) Active osteoclasts

The activation of osteoclasts is a complex process. Surface receptors on the osteoclast precursor cells are called RANK. Receptor activator of nuclear factor â*k*B ligand (RANKL) is expressed on the surface of osteoblasts/stromal cells. The RANKL proteins leave the osteoblast and attach to the RANK receptor on the osteoclast precursor. Macrophage colony stimulating factor then facilitates the production of active osteoclasts from the osteoclast precursor.

Osteoprotegerin (OPG) is an inhibitor that is produced on the cell surface of hematopoietic precursor cells and mature osteoclasts. OPG binds to RANK receptor to inhibit the activation of osteoclasts

RANKL

- Stimulates osteoclast differentiation and osteoclast activity
- Inhibits osteoclast apoptosis
- Induces hypercalcemia when injected
- Loss of expression induces:
    - Osteopetrosis
    - Tooth eruption defects
    - T and B cell differentiation defects

OPG

- Soluble decoy receptor for RANKL
- Blocks osteoclast formation
- Reduces hypercalcemia
- Overexpression induces osteopetrosis
- Loss of expression induces osteoporosis
- Prevents calcification of large arteries

Correct Answer: Osteoclast precursors

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743. (1918) Q2-2328:

Osteoprotegerin (OPG) has which of the following functions or effects:

1) Inhibits osteoclast apoptosis
3) Activates osteoclast precursors
2) Inhibits osteoclast formation
5) Binds to receptor activator of nuclear factor â*k*B ligand (RANKL)
4) Induces hypercalcemia

The activation of osteoclasts is a complex process. Surface receptors on the osteoclast precursor cells are called RANK. Receptor activator of nuclear factor â*k*B ligand (RANKL) is expressed on the surface of osteoblasts/stromal cells. The RANKL proteins leave the osteoblast and attach to the RANK receptor on the osteoclast precursor. Macrophage colony stimulating factor then facilitates the production of active osteoclasts from the osteoclast precursor.

Osteoprotegerin (OPG) is an inhibitor that is produced on the cell surface of hematopoietic precursor cells and mature osteoclasts. OPG binds to RANK receptor to inhibit the activation of osteoclasts.

OPG

- Soluble decoy receptor for RANKL
- Blocks osteoclast formation
- Reduces hypercalcemia
- Overexpression induces osteopetrosis
- Loss of expression induces osteoporosis
- Prevents calcification of large arteries

Correct Answer: Inhibits osteoclast formation

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744. (1919) Q2-2329:

Which of the following proteins or hormones assists in the transport of calcium in the kidney against chemical and electrical gradients:

1) Calcitonin
3) Osteoprotegerin
2) Calbindin
5) Vitamin D3
4) Parathyroid hormone

Calbindin, a vitamin D dependent and calcium binding protein, assists in the transport of calcium against chemical and electrical gradients. Most regulation calcium resorption in the kidney occurs in the distal convoluted segment.Correct Answer: Calbindin

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745. (1920) Q2-2330:

Which of the following is the rate-limiting step in the production of biologically active Vitamin D:

1) 25 hydroxylation in the liver
3) Conversion of 7 dehydrocholesterol to vitamin D3 in the skin
2) Absorption of calcium in the duodenum
5) Absorption of calcium in the jejunum
4) 1 hydroxylation in the kidney

The addition of a second hydroxyl group at the 1 position to 25 hydroxy vitamin D3 is the rate-limiting step in the formation of the active from of vitamin D3. Impaired renal function is common in older individuals.Correct Answer: 1 hydroxylation in the kidney

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746. (1921) Q2-2331:

Which of the following proteins or vitamins controls the amount of receptor activator of nuclear factor â*k*B ligand (RANKL) produced by osteoblasts:

1) Parathyroid hormone
3) Thyroid hormone
2) 25 hydroxyvitamin D3
5) Calcitonin
4) 1,25 dihydroxyvitamin D3

The active from of vitamin D (1,25 dihydroxyvitamin D3) regulates the control of RANKL production by the osteoblast.

The activation of osteoclasts is a complex process. Surface receptors on the osteoclast precursor cells are called RANK. Receptor activator of nuclear factor â*k*B ligand (RANKL) is expressed on the surface of osteoblasts/stromal cells. The RANKL proteins leave the osteoblast and attach to the RANK receptor on the osteoclast precursor. Macrophage colony stimulating factor then facilitates the production of active osteoclasts from the osteoclast precursor.Correct Answer: 1,25 dihydroxyvitamin D3

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747. (1922) Q2-2332:

Which of the following proteins or vitamins influences growth plate chondrocyte maturation as a potent mitogen in the proliferative zone:

1) 1,25 dihydroxyvitamin D3
3) Insulin
2) 24,25 dihydroxyvitamin D3
5) Calcitonin
4) 1 hydroxyvitamin D3

Traditionally, 24,25 dihydroxyvitamin D3 was considered an inactive form of vitamin D. Recent studies suggest that 24,25 dihydroxyvitamin D3 influences growth plate chondrocyte maturation as a potent mitogen in the proliferative zone and may also contribute to bone formation and fracture repair.Correct Answer: 24,25 dihydroxyvitamin D3

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748. (1923) Q2-2333:

Which of the following cells has receptors for parathyroid hormone:

1) Osteocytes
3) Plasma cells
2) Osteoclasts
5) Osteoclast precursor cells
4) Osteoblasts

Osteoblasts have receptors for parathyroid hormone. Once stimulated, the cells release interleukin-6 (IL-6). IL-6 signals osteoclasts to resorb bone. The osteoblasts secrete neutral proteases that degrade the osteoid surface. Osteoclasts then attach to the bone surface and secrete acid proteases that degrade the bone matrix. Parathyroid hormone related protein increases osteoblast expression of receptor activator of nuclear factor â*k*B ligand (RANKL). RANKL binds to osteoclast precursor cells for the formation of active osteoclasts.Correct Answer: Osteoblasts

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749. (1924) Q2-2334:

Parathyroid hormone stimulates which of the following cells to secrete neutral protease that degrades the osteoid bone surface:

1) Osteoblasts
3) Osteoclasts
2) Mast cells
5) Osteoclast precursor cells
4) Osteocytes

Osteoblasts have receptors for parathyroid hormone. Osteoblasts have neutral proteases that begin the degradation of the osteoid matrix. Once stimulated, the cells release interleukin-6 (IL-6). IL-6 signals osteoclasts to resorb bone. The osteoblasts secrete neutral proteases that degrade the osteoid surface. Osteoclasts then attach to the bone surface and secrete acid proteases that degrade the bone matrix. Parathyroid hormone related protein increases osteoblast expression of receptor activator of nuclear factor â*k*B ligand (RANKL). RANKL binds to osteoclast precursor cells for the formation of active osteoclasts.Correct Answer: Osteoblasts

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750. (1925) Q2-2335:

Parathyroid hormone inhibits the production of:

1) Osteoprotegerin
3) Interleukin-6
2) 1,25 dihydroxyvitamin D3 production
5) Receptor activator of nuclear factor â*k*B ligand (RANKL)
4) Kidney 1 alpha-hydroxylase

Parathyroid hormone inhibits the production of osteoprotegerin. Osteoprotegerin is a decoy inhibitor of the receptor activator of nuclear factor â*k*B. Osteoprotegerin inhibits osteoclast activation.Correct Answer: Osteoprotegerin

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751. (1926) Q2-2336:

Osteoclasts have receptors for which of the following:

1) 1,25 dihydroxyvitamin D3
3) Osteoprotegerin
2) Parathyroid hormone
5) Calcitonin
4) Receptor activator of nuclear factor â*k*B

Osteoclasts have receptors for calcitonin. Calcitonin causes osteoclasts to shrink in size and reduces their ability to resorb bone.Correct Answer: Calcitonin

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752. (1927) Q2-2337:

After oophorectomy or menopause, bone loss per year is estimated to be:

1) 0.3% to 0.5%
3) 5% to 10%
2) 2% to 3%
5) 15% to 20%
4) 10% to 15%

The normal estimated age-related bone loss per year is 0.5%. After oophorectomy or during the first 6 to 8 years after menopause, bone loss can be as high as 2.0% to 3.0% per year.Correct Answer: 2% to 3%

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753. (1928) Q2-2338:

Estrogen deficiency results in which of the following:

1) Increased interleukin-6 (IL-6) expression
3) Decreased IL-6 expression
2) Increased osteoprotegerin (OPG) expression
5) Decreased macrophage colony-stimulating factor (M-CSF) expression
4) Decreased receptor activator of nuclear factor â*k*B ligand (RANKL)

Estrogen deficiency results in increased bone resorption. An increase in IL-6 expression stimulates osteoclasts to resorb bone.

An increase in M-CSF and RANKL results in increased osteoclastic activity. OPG decreases osteoclastic activity as a decoy inhibitor of RANK.Correct Answer: Increased interleukin-6 (IL-6) expression

---

754. (1929) Q2-2339:

Androgens prevent bone resorption. Receptors for androgens are found on which of the following cells:

1) Osteoclasts
3) Osteoblasts
2) Osteoclast precursor cells
5) Mast cells
4) Osteocytes

Osteoblasts have receptors for androgens. Although androgens prevent bone resorption and may increase bone mass, the process is not understood at this time.Correct Answer: Osteoblasts

---

755. (1930) Q2-2340:

Corticosteroids decrease bone mass through which of the following mechanisms:

1) Inhibiting calcium absorption in the intestines
3) Increasing calcium binding proteins
2) Decreasing calcium excretion in the kidneys
5) Increasing bone resorption at high doses
4) Increasing overall protein synthesis

Corticosteroids decrease overall protein synthesis. In the intestines, corticosteroids decrease calcium-binding proteins, hence decreasing the absorption of calcium.

Corticosteroids:

- Decrease overall protein synthesis
- Increase calcium excretion in the kidney
- Inhibit bone formation and absorption at high doses

With the above changes, a state of secondary hyperparathyroidism exists.

Correct Answer: Inhibiting calcium absorption in the intestines

---

756. (1931) Q2-2341:

Which of the following defines osteoporosis according to the World Health Organization:

1) 0.5 to 1.0 standard deviation (SD) below age-matched controls
3) 1.0 to 2.5 SD below age-matched controls
2) 1.0 to 2.0 SD below age-matched controls
5) 2.5 to 5.0 SD below age-matched controls
4) More than 2.5 SD below age-matched controls

Osteoporosis is a condition in which there is a deficiency of bone mass and microarchitectural deterioration of bone tissue. Osteoporosis is defined as a bone mass that is more than 2.5 SD below the mean for age-matched controls. Patients are considered osteopenic with mild to moderate bone deficiency with a bone density of 1.0 to 2.5 SD.Correct Answer: More than 2.5 SD below age-matched controls

---

757. (1932) Q2-2342:

Which of the following features is associated with type 1 osteoporosis:

1) Primarily occurs in patients older than 75 years of age
3) Cortical and trabecular bone are affected
2) Female to male ratio is 2:1
5) Related to estrogen deficiency rather than calcium intake
4) Low turnover osteoporosis

Type 1 osteoporosis is the most common form of osteoporosis and is found in women during postmenopausal years. Type 1 osteoporosis is related to estrogen deficiency rather than a problem in calcium intake or absorption.

Features of type 1 osteoporosis include:

- Female to male ratio is 6:1
- High turnover osteoporosis
- Bone loss rate of 2% to 3% per year for 6 to 10 years following menopause
- Trabecular bone is most affected
- Related to estrogen deficiency rather than calcium intake

Correct Answer: Related to estrogen deficiency rather than calcium intake

---

758. (1933) Q2-2343:

Which of the following features is associated with type 2 osteoporosis:

1) High turnover osteoporosis
3) Loss of cortical and trabecular bone
2) Female to male ratio is 6:1
5) Greatest bone loss in the first 6 to 10 years following menopause
4) Related to estrogen deficiency

Type 1 osteoporosis is the most common form of osteoporosis and is found in women during postmenopausal years. Type 1 osteoporosis is related to estrogen deficiency rather than a problem in calcium intake or absorption.

Features of type 1 osteoporosis include:

- Female to male ratio is 6:1
- High turnover osteoporosis
- Bone loss rate of 2% to 3% per year for 6 to 10 years following menopause
- Trabecular bone is most affected
- Related to estrogen deficiency rather than calcium intake

Type 2 osteoporosis, also called senile or involutional osteoporosis, is a low turnover osteoporosis and principally occurs in patients older than 75 years of age.

Features of type 2 osteoporosis include:

- Female to male ratio is 2:1
- Patients older than 75 years of age
- Low turnover osteoporosis
- Trabecular and cortical bone affected
- Associated with hip fractures
- Related to a lifelong deficiency of calcium

Correct Answer: Loss of cortical and trabecular bone

---

759. (1934) Q2-2344:

Which of the following statements is false regarding the use of estrogen therapy to prevent osteoporosis:

1) Osteoblasts have estrogen receptors.
3) Estrogen decreases osteoclast activity.
2) Estrogen modulates calcium absorption and renal excretion.
5) The protective effect of estrogren therapy continues to prevent bone loss after therapy is discontinued.
4) Estrogen prevents osteoporosis in 80% of postmenopausal women.

Estrogen therapy is one of the main therapeutic interventions used to prevent osteoporosis in postmenopausal women.

Features of estrogen interactions include:

- Osteoblasts have estrogen receptors.
- Estrogen indirectly affects calcium metabolism by modulating calcium absorption and renal excretion.
- Estrogen decreases osteoclast activity.
- Estrogen prevents osteoporosis in 80% of postmenopausal women.
- The protective effect of estrogren therapy ends when therapy is discontinued.

Correct Answer: The protective effect of estrogren therapy continues to prevent bone loss after therapy is discontinued.

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760. (1935) Q2-2345:

Which of the following drugs is a selective estrogen receptor modulator:

1) Fosamax (alendronate sodium tablets, Merck & Co., Inc.)
3) Aredia (pamidronate disodium for injection, Novartis Pharmaceuticals Corporation)
2) Progestin
5) Alendronate sodium
4) Evista (raloxifene, Eli Lilly and Company)

A new class of selective estrogen receptor modulator acts as an antagonist in breast tissue and an agonist in bone. Raloxifene selectively stimulates estrogen receptors in bone and is an antagonist in breast tissue.

Progestin used in conjunction with estrogen opposes the action of estrogen and lowers the risk of endometrial cancer that might occur with estrogen therapy alone.

Aredia, Fosamax, and alendronate are biphosphonates that inhibit osteoclasts, thereby decreasing bone resorption.Correct Answer: Evista (raloxifene, Eli Lilly and Company)

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761. (1936) Q2-2346:

Which of the following mechanisms of bisphosphonate action occurs when a bisphosphonate is used to treat osteoporosis:

1) Increasing calcium absorption in the intestines
3) Stimulating osteoblast precursors
2) Decreasing urinary excretion of calcium
5) Increasing phosphate reabsorption in the kidney
4) Binding to hydroxyapatite crystals

Bisphosphonates are effective in the treatment of osteoporosis because they bind to the hydroxyapatite crystals and inhibit crystal resorption.

Other effects of bisphosphonates include:

- Reducing production of proteins and lysosomal enzymes by osteoclasts
- Reducing the formation of new bone remodeling units
- Inducing osteoclast cell death
- Reducing the formation of new osteoclasts

After 1 year of treatment, alendronate decreases fracture rates (hip, spine, and wrist) by 50%. Bone mass gains are modest â 2% to 4% per year in the vertebra and 1% to 2% per year in the hip.Correct Answer: Binding to hydroxyapatite crystals

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762. (1937) Q2-2347:

Which of the following is a significant side effect of biphosphonates (e.g., alendronate):

1) Pruritus
3) Peripheral edema
2) Dizziness
5) Light sensitivity
4) Esophagitis and dyspepsia

The most significant side effect of biphosphonates is esophagitis and dyspepsia. Biphosphonates must be taken on an empty stomach with no oral intake for 30 minutes. In addition, patients should remain upright.Correct Answer: Esophagitis and dyspepsia

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763. (1938) Q2-2348:

Which of the following conditions is characterized by decreased osteoclastic resorption of bone and cartilage with normal bone formation:

1) Type 1 osteoporosis
3) Osteopetrosis
2) Type 2 osteoporosis
5) Secondary hyperparathyroidism
4) Pagetâs disease

Osteopetrosis is a rare disorder in which there is decreased osteoclastic resorption of bone and cartilage with normal bone formation. There are a number of different forms of the condition.

The most common form of osteopetrosis is an autosomal dominant type with mild features (adult or tarda). Patients may have mild anemia, have one or more fractures, or be asymptomatic.

The juvenile form of osteopetrosis is a severe autosomal disorder. Children have multiple fractures, severe anemia, thrombocytopenia, and hepatosplenomegaly. Effected children are also immunocompromised.Correct Answer: Osteopetrosis

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764. (1939) Q2-2349:

Which of the following is an effective medication for osteopetrosis:

1) Calcitonin
3) Fosamax (alendronate sodium tablets, Merck & Co., Inc.)
2) Alendronate
5) Interferon gamma-1
4) Calcium carbonate

Interferon gamma-1 is the only treatment for osteopetrosis that is approved by the Food and Drug Administration.Correct Answer: Interferon gamma-1

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765. (2215) Q2-2642:

Which of the following is the proper sequence when listing materials in order of increasing elastic modulus:

1) Cancellous bone, methylmethacrylate, cortical bone, titanium, and cobalt chrome
3) Methylmethacrylate, cancellous bone, titanium, cortical bone, and cobalt chrome
2) Cancellous bone, cortical bone, titanium, methylmethacrylate, and cobalt chrome
5) Titanium, cobalt chrome, methylmethacrylate, cancellous bone, and cortical bone
4) Titanium, cancellous bone, methylmethacrylate, cortical bone, and cobalt chrome

The proper sequence when listing common orthopedic biomaterials in order of increasing modulus is:

Elastic Modulus

Cancellous bone

Polyethylene

Methylmethacrylate

Cortical bone

Titanium alloy

Stainless steel

Cobalt chrome

Correct Answer: Cancellous bone, methylmethacrylate, cortical bone, titanium, and cobalt chrome

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766. (2329) Q2-2784:

Which of the following areas results in latitudinal physeal enlargement:

1) Proliferative zone
3) Reserve zone
2) Provisional calcification zone
5) Perichondrial ring of La Croix
4) Hypertrophic zone

The perichondrial ring of La Croix is the source of cells which differentiate into chondrocytes and results in latitudinal physeal enlargement.

The other answers refer to specific growth plate zones which have functions. The reserve zone is for matrix production and storage. The proliferative zone is for matrix production and cellular proliferation. The hypertrophic zone contains the zone of maturation, degeneration, and provisional calcification.

Correct Answer: Perichondrial ring of La Croix

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767. (2330) Q2-2785:

The abrupt appearance of which of the following collagens heralds the onset of ossification in the physis:

1) Type I
3) Type X
2) Type VI
5) Type IX
4) Type II

The terminal hypertrophic chondrocytes in the hypertrophic zone produce Type X collagen. The appearance of Type X collagen heralds ossification. Remember that Type II collagen is the most abundant collagen in the hypertrophic zone.Correct Answer: Type X

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768. (2331) Q2-2786:

Which of the following zones of the physis is involved in Salter Harris Type I and II fractures:

1) Proliferative zone
3) Reserve zone
2) Perichondrial ring
5) Zone of provisional calcification
4) Node of Ranvier

Salter Harris Type I and II fractures occur through the zone of provisional calcification or through the hypertrophic zone. The reserve and proliferative zone remain intact and growth can proceed normal after healing of the fracture.Correct Answer: Zone of provisional calcification

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769. (2332) Q2-2787:

Which of the following is the most likely origin for the greater medullary artery:

1) Lower cervical segmental
3) Upper lumbar segmental
2) Middle thoracic segmental
5) Lower thoracic segmental
4) Upper thoracic segmental

The major part of the blood supply of the spinal cord is provided by the medullary or radicular arteries. The only feeder for the lower thoracic spinal cord is the greater medullary artery or artery of Adamkiwicz (T9-T11). One should remember that in the spine, the right-sided approach is preferred to avoid the aorta and segmental artery of Adamkiwicz.Correct Answer: Lower thoracic segmental

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770. (2333) Q2-2788:

Enchondral ossification is responsible for mineralization in all of the following conditions except:

1) Heterotopic bone formation
3) Callus formation during fracture healing
2) Embryonic long bone development
5) Perichondrial bone formation
4) Cartilage degeneration in osteoarthritis

Enchondral bone formation or ossification is bone formation on a cartilage model. Enchondral bone formation occurs in embryonic long bone development, epiphyseal secondary center of ossification formation, callus formation during fracture healing, degenerating cartilage of osteoarthritis, calcifying cartilage tumors, and bone formed with use of demineralized bone matrix.

Intramembranous bone formation occurs in flat bone development (pelvis, clavicle, skull bones), bone formation during distraction osteogenesis, and perichondrial bone formation.Correct Answer: Perichondrial bone formation

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771. (2334) Q2-2790:

Which of the following is true concerning cancellous bone:

1) It remodels through surface cells
3) It has high density
2) It has low surface area
5) It has a low metabolic rate and turnover
4) It is organized in osteons and lamellae

Cortical bone has a much greater density than cancellous bone. Therefore, it is stiffer and stronger. Cortical bone has a higher density than cancellous bone, is organized into osteons and lamellae, has low surface area, lower metabolic rate than cancellous bone, remodels through osteons, and accounts for much of the structural strength of bones.

Cancellous bone has a lower density than cortical bone, has an organization of lamellar bone, has a high surface area, higher metabolic rate than cortical bone, remodels through surface cells, and transmits forces in subchondral location.

Correct Answer: It remodels through surface cells

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772. (2449) Q2-2914:

Which of the following statements is true regarding metaphyseal cortical bone formation in a child with open physes:

1) Cortical bone is formed by intramembranous bone formation.
3) Cortical bone is formed by coalescence of enchondral trabecular bone.
2) Cortical bone is formed by intramembranous and enchondral bone formation.
5) Cortical bone is formed from the groove of Ranvier.
4) Cortical bone is solely formed from the periosteal bone.

Cadet and colleagues studied the formation of cortical bone in the metaphyses of rabbits. They found that the metaphyseal cortical bone is formed by coalescence of enchondral trabecular bone.

Important points from this study include:

- Metaphyseal cortical bone is formed by coalescence of enchondral trabecular bone.
- The coalescence is formed by an increased osteoblast surface.
- The increased osteoblast surface is likely caused by factors from the periosteum.
- The bone that is produced by the cells in the groove of Ranvier probably does not contribute to the metaphyseal cortical bone.

Correct Answer: Cortical bone is formed by coalescence of enchondral trabecular bone.

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773. (2450) Q2-2915:

Which of the following molecules influences embryonic bone formation and fracture healing:

1) Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1)
3) Platelet derived growth factor (PDGF)
2) Transforming growth factor-beta (TGF-B)
5) Vascular endothelial growth factor (VEGF)
4) Interleukin-1 (IL-1)

Important concepts to remember regarding signaling proteins include:

- Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1) influence embryonic bone formation and fracture healing.
- Vascular endothelial growth factor (VEGF) plays a role in cartilage hypertrophy at the growth plate and during fracture healing.
- Transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF) are found in early fracture hematoma, and these factors modulate cell proliferation and differentiation.
- Bone morphogenetic protein and interleukin 1 and 6 are expressed during cartilage formation.

Correct Answer: Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1)

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774. (2451) Q2-2916:

Which of the following molecules are present in a hematoma after a fracture and aid in modulating cell proliferation and differentiation:

1) Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1)
3) Interleukin-1 (IL-1)
2) Transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF)
5) Vascular endothelial growth factor (VEGF)
4) Interleukin-6 (IL-6)

Important concepts to remember regarding signaling proteins include:

- Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1) influence embryonic bone formation and fracture healing.
- Vascular endothelial growth factor (VEGF) plays a role in cartilage hypertrophy at the growth plate and during fracture healing.
- Transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF) are found in early fracture hematoma, and these factors modulate cell proliferation and differentiation.
- Bone morphogenetic protein and interleukin 1 and 6 are expressed during cartilage formation.

Correct Answer: Transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF)

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775. (2452) Q2-2917:

Which of the following molecules play an important role in cartilage hypertrophy during growth plate development and ossification in fracture healing:

1) Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1)
3) Interleukin-1 (IL-1)
2) Transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF)
5) Vascular endothelial growth factor (VEGF)
4) Interleukin-6 (IL-6)

Important concepts to remember regarding signaling proteins include:

- Indian hedgehog (IHH) and core binding factor alpha 1 (Cbfa1) influence embryonic bone formation and fracture healing.
- Vascular endothelial growth factor (VEGF) plays a role in cartilage hypertrophy at the growth plate and during fracture healing.
- Transforming growth factor-beta (TGF-B) and platelet derived growth factor (PDGF) are found in early fracture hematoma, and these factors modulate cell proliferation and differentiation.
- Bone morphogenetic protein and interleukin 1 and 6 are expressed during cartilage formation.

Correct Answer: Vascular endothelial growth factor (VEGF)

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776. (2453) Q2-2918:

All of the following factors are important to achieve primary osteonal healing during plate fixation except:

1) Anatomic reduction
3) Adequate vascular supply
2) Rigid fixation
5) Very low strain levels
4) Moderate-to-high strain levels

In primary osteonal bone healing, osteoclasts cut channels across the bone contact sites and blood vessels, and osteoblasts fill in the gap with new bone.

To achieve osteonal healing, there must be an anatomic reduction with rigid fixation, an adequate blood supply, and the amount of motion at the fracture site must be very small to none (very low strain levels).

Moderate-to-high strain levels occur if there is motion at the osteosynthesis site. This motion results from poor fixation (lack of rigidity) or excessive loading during the healing period. High strain levels in the gap favor the formation of granulation tissue rather than bone.

Correct Answer: Moderate-to-high strain levels

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777. (2454) Q2-2919:

All of the following factors increase the rigidity of an external fixator except:

1) Increased individual pin diameter
3) Increased bone-to-rod distance
2) Increased pin number
5) Separating half pins by 45Â°
4) Increased pin group separation

There are many factors that increase the rigidity of an external fixator, including:

- Increased pin diameter
- Increased pin number
- Decreased bone-to-rod distance
- Increased pin group separation
- Separating half pins by 45Â°

Increasing the bone-to-rod distance decreases the rigidity of the system. The fracture gap is also important. The fracture gap should be minimized for excellent bone apposition.

Correct Answer: Increased bone-to-rod distance

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778. (2455) Q2-2920:

Which of the following graft types has both osteoinductive and osteoconductive properties:

1) Autogenous bone marrow
3) Bone morphogenetic protein-2 (BMP-2)
2) Coral-based hydroxyapatite bone graft substitute
5) Cancellous bone graft
4) Recombinant bone morphogenetic protein-7 (rhBMP-7)

Grafting materials may include osteoconductive and/or osteoinductive properties and osteoprogenitor cells.

Cancellous bone and vascularized bone graft are the only materials that have significant osteoconductive, osteoinductive, and osteoprogenitor cells.

Several materials are mainly osteoinductive. Remember the definition of osteoinductive and osteoconductive properties:

Osteoinductive factors: Molecules that have the capability of inducing osteoblastic precursors to differentiate into mature bone forming cells.

Osteoinductive factors (without significant osteoconductive properties) include growth factors such as BMP-2 and rhBMP-7 (OP-1, Stryker Biotech, Hopkinton, Mass) and demineralized bone matrix.

Osteoconductive factors: The ability of a porous material to provide a scaffold for new bone formation.

Osteoconductive materials (without significant osteoinductive properties) include ceramics such as coral-based hydroxyapatite graft substitutes, Norian skeletal repair system (Norian Corporation, Cupertino, Calif), and calcium sulfate pellets (Osteoset, Wright Medical Technology Inc., Arlington, Tenn).

Bone marrow has the potential of supplying osteoprogenitor cells but has little osteoinductive or osteoconductive properties.

Correct Answer: Cancellous bone graft

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779. (2456) Q2-2921:

Which of the following materials has mainly osteoconductive properties with little or no osteoinductive ability:

1) Autogenous bone marrow
3) Bone morphogenetic protein-2 (BMP-2)
2) Coral-based hydroxyapatite bone graft substitute
5) Cancellous bone graft
4) Recombinant bone morphogenetic protein-7 (rhBMP-7)

Grafting materials may include osteoconductive and/or osteoinductive properties and osteoprogenitor cells.

Cancellous bone and vascularized bone graft are the only materials that have significant osteoconductive, osteoinductive, and osteoprogenitor cells.

Several materials are mainly osteoinductive. Remember the definition of osteoinductive and osteoconductive properties:

Osteoinductive factors: Molecules that have the capability of inducing osteoblastic precursors to differentiate into mature bone forming cells.

Osteoinductive factors (without significant osteoconductive properties) include growth factors such as BMP-2 and rhBMP-7 (OP-1, Stryker Biotech, Hopkinton, Mass) and demineralized bone matrix.

Osteoconductive factors: The ability of a porous material to provide a scaffold for new bone formation.

Osteoconductive materials (without significant osteoinductive properties) include ceramics such as coral-based hydroxyapatite graft substitutes, Norian skeletal repair system (Norian Corporation, Cupertino, Calif), and calcium sulfate pellets (Osteoset, Wright Medical Technology Inc., Arlington, Tenn).

Bone marrow has the potential of supplying osteoprogenitor cells but has little osteoinductive or osteoconductive properties.

Correct Answer: Coral-based hydroxyapatite bone graft substitute

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780. (2457) Q2-2922:

Which of the following materials has mainly osteoinductive properties with little or no osteoconductive ability:

1) Autogenous bone marrow
3) Calcium sulfate crystals
2) Coral-based hydroxyapatite bone graft substitute
5) Cancellous bone graft
4) Recombinant bone morphogenetic protein-7 (rhBMP-7)

Grafting materials may include osteoconductive and/or osteoinductive properties and osteoprogenitor cells.

Cancellous bone and vascularized bone graft are the only materials that have significant osteoconductive, osteoinductive, and osteoprogenitor cells.

Several materials are mainly osteoinductive. Remember the definition of osteoinductive and osteoconductive properties:

Osteoinductive factors: Molecules that have the capability of inducing osteoblastic precursors to differentiate into mature bone forming cells.

Osteoinductive factors (without significant osteoconductive properties) include growth factors such as BMP-2 and rhBMP-7 (OP-1, Stryker Biotech, Hopkinton, Mass) and demineralized bone matrix.

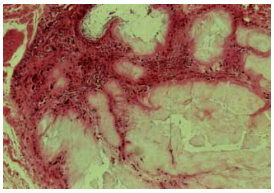
Osteoconductive factors: The ability of a porous material to provide a scaffold for new bone formation.

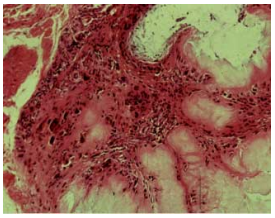
Osteoconductive materials (without significant osteoinductive properties) include ceramics such as coral-based hydroxyapatite graft substitutes, Norian skeletal repair system (Norian Corporation, Cupertino, Calif), and calcium sulfate pellets (Osteoset, Wright Medical Technology Inc., Arlington, Tenn).

Bone marrow has the potential of supplying osteoprogenitor cells but has little osteoinductive or osteoconductive properties.

Correct Answer: Recombinant bone morphogenetic protein-7 (rhBMP-7)

781. (2458) Q2-2923:





Slide 1 **Slide 2** **Slide 3**

A 65-year-old man has severe foot pain. His plain radiograph is shown in Slide 1, and a needle biopsy specimen in Slides and 3. The most likely diagnosis is:

1) Coccidioidomycosis
3) Rheumatoid arthritis
2) Pigmented villonodular synovitis
5) Tuberculosus
4) Gout

Gout is caused by the deposition of monosodium urate crystals in tissues, typically around joints. Common locations of gout include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first affected location is the great toe. Gout commonly occurs inside a joint for two reasons - synovial fluid is a poorer solvent than plasma and lower temperatures (as in peripheral joints) favor crystallization.

Neutrophils ingest the crystals and release potent lysosomal enzymes. Punched lesions may be seen on radiographs in chronic cases, and one can often see an overlying lip of cortex at the edge of the lesion.

Histologically, the tophi have several features:

- Acellular amorphous material
- Macrophages
- Foreign body giant cells

In this patient, the joint space is preserved on the plain radiographs. The biopsy specimen has the characteristic features of gout - acellular amorphous material, macrophages, and foreign body giant cells.

Correct Answer: Gout

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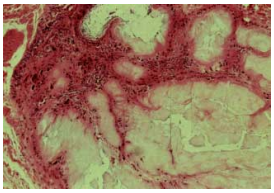
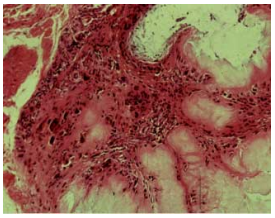
782. (2459) Q2-2924:





Slide 1 **Slide 2** **Slide 3**

A 65-year-old man has severe foot pain. His plain radiograph is shown in Slide 1, and a needle biopsy specimen in Slides 2 and 3. The most appropriate treatment for this patient is:

1) Irrigation/debridement followed by antibiotics
3) Diphosphonate therapy
2) Chemotherapy followed by wide resection
5) Arthroscopic debridement
4) Nonsteriodal anti-inflammatory agents

Gout is caused by the deposition of monosodium urate crystals in tissues, typically around joints. Common locations of gout include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first affected location is the great toe. Gout commonly occurs inside a joint for two reasons - synovial fluid is a poorer solvent than plasma and lower temperatures (as in peripheral joints) favor crystallization.

Neutrophils ingest the crystals and release potent lysosomal enzymes. Punched lesions may be seen on radiographs in chronic cases, and one can often see an overlying lip of cortex at the edge of the lesion.

Histologically, the tophi have several features:

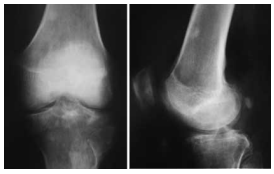
- Acellular amorphous material
- Macrophages
- Foreign body giant cells

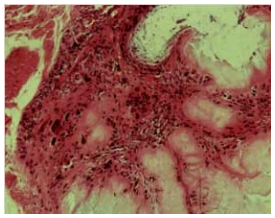
In this patient, the joint space is preserved on the plain radiographs. The biopsy specimen has the characteristic features of gout - acellular amorphous material, macrophages, and foreign body giant cells.

The treatment of gout includes nonsteroidal anti-inflammatory drugs and medications such as allopurinol and colchicines, which lower hyperuricemia.

Correct Answer: Nonsteriodal anti-inflammatory agents

783. (2460) Q2-2925:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 60-year-old man has severe knee pain. His plain radiographs are shown in Slide 1. His T1- and T2-weighted sagittal magnetic resonance images (MRIs) are shown in Slides 2 and 3. A biopsy specimen is shown in Slide 4. The most likely diagnosis is:

1) Coccidioidomycosis
3) Rheumatoid arthritis
2) Pigmented villonodular synovitis
5) Tuberculosus
4) Gout

Gout is caused by the deposition of monosodium urate crystals in tissues, typically around joints. Common locations of gout include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first affected location is the great toe. Gout commonly occurs inside a joint for two reasons - synovial fluid is a poorer solvent than plasma and lower temperatures (as in peripheral joints) favor crystallization.

Neutrophils ingest the crystals and release potent lysosomal enzymes. Punched lesions may be seen on radiographs in chronic cases, and one can often see an overlying lip of cortex at the edge of the lesion.

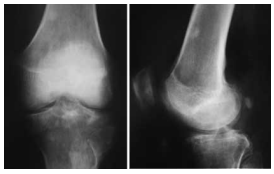
Histologically, the tophi have several features:

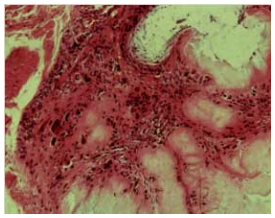
- Acellular amorphous material
- Macrophages
- Foreign body giant cells

In this patient, the joint space is preserved on the plain radiographs. The MRI scans show periarticular erosions. The biopsy specimen has the characteristic features of gout - acellular amorphous material, macrophages, and foreign body giant cells.

Correct Answer: Gout

784. (2461) Q2-2926:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 60-year-old man has severe knee pain. His plain radiographs are shown in Slide 1. His T1- and T2-weighted sagittal magnetic resonance images (MRIs) are shown in Slides 2 and 3. A biopsy specimen is shown in Slide 4. The most appropriate treatment for this patient is:

1) Irrigation/debridement followed by antibiotics
3) Diphosphonate therapy
2) Chemotherapy followed by wide resection
5) Arthroscopic debridement
4) Nonsteriodal anti-inflammatory agents

Gout is caused by the deposition of monosodium urate crystals in tissues, typically around joints. Common locations of gout include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first affected location is the great toe. Gout commonly occurs inside a joint for two reasons - synovial fluid is a poorer solvent than plasma and lower temperatures (as in peripheral joints) favor crystallization.

Neutrophils ingest the crystals and release potent lysosomal enzymes. Punched lesions may be seen on radiographs in chronic cases, and one can often see an overlying lip of cortex at the edge of the lesion.

Histologically, the tophi have several features:

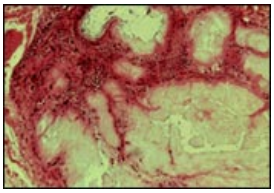
- Acellular amorphous material
- Macrophages
- Foreign body giant cells

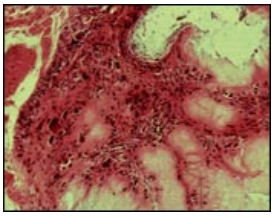
In this patient, the joint space is preserved on the plain radiographs. The biopsy specimen has the characteristic features of gout - acellular amorphous material, macrophages, and foreign body giant cells.

The treatment of gout includes nonsteroidal anti-inflammatory drugs and medications such as allopurinol and colchicines, which lower hyperuricemia.

Correct Answer: Nonsteriodal anti-inflammatory agents

785. (2571) Q2-3044:





Slide 1 **Slide 2** **Slide 3**

A 55-year-old man has severe wrist pain with erythema and soft tissue swelling. The plain radiograph is shown in Slide 1 and a biopsy specimen is shown in Slide 2 and Slide 3. The most likely diagnosis is:

1) Septic arthritis
3) Gout
2) Osteomyelitis
5) Tuberculosis
4) Metastatic lung carcinoma

The plain radiographs show a destructive lesion in the wrist in the distal radius and at the scaphotrapezial joint. The joint spaces are preserved. The histology shows the features of gout: acellular amorphous tissue, macrophages, and giant cells.

Gout is caused by the deposition of monosodium urate crystals in tissues typically around joints. Common locations include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first attack is in the great toe. Gout commonly occurs inside a joint for two reasons:

- The synovial fluid is a poorer solvent than plasma
- Lower temperatures (as in peripheral joints) favor crystallization

Neutrophils ingest the crystals and then release potent lysosomal enzymes. Punched lesions may be seen on radiographs in chronic cases. One can often see an overlying lip of cortex at the edge of the lesion.

Histologically, the tophi have several features:

- Acellular amorphous material
- Macrophages
- Foreign body giant cells

Correct Answer: Gout

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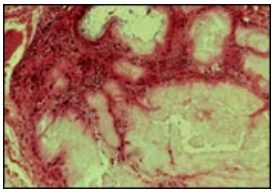
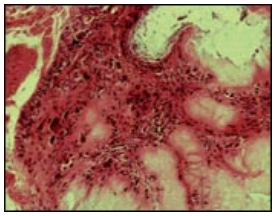
786. (2572) Q2-3045:





Slide 1 **Slide 2** **Slide 3**

A 55-year-old man has severe wrist pain with erythema and soft tissue swelling. The plain radiograph is shown in Slide 1 and a biopsy specimen is shown in Slide 2 and Slide 3. Which of the following would be the best treatment:

1) Debridement and antibiotics
3) External beam irradiation
2) Nonsteroidal anti-inflammatory medications
5) Thumb basal joint arthroplasty
4) Wide resection and wrist fusion

The plain radiographs show a destructive lesion in the wrist in the distal radius and at the scaphotrapezial joint. The joint spaces are preserved. The histology shows the features of gout: acellular amorphous tissue, macrophages, and giant cells.

Gout is caused by the deposition of monosodium urate crystals in tissues typically around joints. Common locations include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first attack is in the great toe. Gout commonly occurs inside a joint for two reasons:

- The synovial fluid is a poorer solvent than plasma
- Lower temperatures (as in peripheral joints) favor crystallization

Neutrophils ingest the crystals and then release potent lysosomal enzymes. Histologically, the tophi have several features:

- Acellular amorphous material
- Macrophages
- Foreign body giant cells

The first line of treatment is nonsteroidal anti-inflammatory medications.

Correct Answer: Nonsteroidal anti-inflammatory medications

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787. (2573) Q2-3046:

Which of the following statements is true regarding gout:

1) Gout is more common in females than males.
3) Gout is very common in heart transplant patients on cyclosporine.
2) Urate overproduction is the most common cause.
5) Joint space destruction is an early radiographic finding.
4) The serum uric acid level is always elevated in an acute attack.

Gout is caused by the deposition of monosodium urate crystals in tissues typically around joints. Common locations include the great toe, heel, ankle, and knee. In approximately 50% of patients, the first attack is in the great toe. Gout commonly occurs inside a joint for two reasons:

- The synovial fluid is a poorer solvent than plasma
- Lower temperatures (as in peripheral joints) favor crystallization

One should remember the following:

- Gout is much more common in males (ratio of 20:1).
- An inability to excrete uric acid is the primary cause.
- Gout is very common in transplant patients taking cyclosporine.
- Serum uric acid level is often normal in an acute attack.
- Joint space is usually preserved on plain radiographs (early disease).

Correct Answer: Gout is very common in heart transplant patients on cyclosporine.

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788. (2574) Q2-3047:

Slide 1

Slide 2

A 9-year-old boy has a history of multiple fractures. He presents with left leg pain following a minor fall. His anteroposterior (Slide 1) and lateral (Slide 2) plain radiographs are shown. Which of the following is the most likely diagnosis:

1) Child abuse
3) Osteopetrosis
2) Osteomalacia (rickets)
5) Leukemia
4) Osteogenesis imperfecta

The anteroposterior and lateral radiographs show thinned cortices and a gentle S-shaped curve of the tibia. The overall alignment of the tibia, as well as the physes, is normal. These are the radiographic features of osteogenesis imperfecta.

Child abuse, osteomalacia (rickets), osteopetrosis, and leukemia must be distinguished from osteogenesis imperfecta. In child abuse, multiple fractures are at different stages of healing. Osteomalacia has widened physes and osteopetrosis has marked bone sclerosis and absence of a medullary cavity. Patients with leukemia have lytic destructive lesions.

In osteogenesis imperfecta, the genetic defect involves type I collagen. Type I collagen is made up of two alpha-1 chains and one alpha-2 chain in a triple helix. Glycine is the smallest amino acid and is crucial for coiling of the triple helix. Mutations in the glycine chain lead to severe forms of osteogenesis imperfecta.

One should also remember the Silence classification:

Type	Inheritance	Sclera	Severity
I	AD	Blue	Mild form, normal teeth
II	AR	Blue	Lethal form, die early
III	AR	Normal	Severe, progressively deforming
IV	AD	Normal	Moderately severe

Biphosphonate therapy can be used to slow bone remodeling and increase bone mass.

Correct Answer: Osteogenesis imperfecta

789. (2575) Q2-3048:

Slide 1

Slide 2

A 9-year-old boy has a history of multiple fractures. He presents with left leg pain following a minor fall. His anteroposterior (Slide 1) and lateral (Slide 2) plain radiographs are shown. The most likely genetic defect would be:

1) FGF receptor 3
3) Cartilage oligomeric matrix protein
2) Type I collagen
5) Type II collagen
4) Fibrillin

The anteroposterior and lateral radiographs show thinned cortices and a gentle S-shaped curve of the tibia. The overall alignment of the tibia, as well as the physes, is normal. These are the radiographic features of osteogenesis imperfecta.

In osteogenesis imperfecta, the genetic defect involves type I collagen. Type I collagen is made up of two alpha-1 chains and one alpha-2 chain in a triple helix. Glycine is the smallest amino acid and is crucial for coiling of the triple helix. Mutations in the glycine chain lead to severe forms of osteogenesis imperfecta.

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II	AR	Blue	Lethal form, die early
III	AR	Normal	Severe, progressively deforming
IV	AD	Normal	Moderately severe

Biphosphonate therapy can be used to slow bone remodeling and increase bone mass.

With regard to the incorrect choices:

- FGF receptor 3 is associated with achondroplasia.
- Fibrillin is associated with Marfan's syndrome.
- Type II collagen is associated with spondyloepiphyseal dsyplasia.
- Cartilage oligomeric matrix protein is associated with pseudoachondroplasia.

Correct Answer: Type I collagen

790. (2576) Q2-3049:

Slide 1

Slide 2

A 9-year-old boy has a history of multiple fractures. He presents with left leg pain following a minor fall. His anteroposterior (Slide 1) and lateral (Slide 2) plain radiographs are shown. Which of the following can be an effective pharmacologic treatment:

1) Diphosphonate therapy
3) Cytotoxic multi-agent chemotherapy
2) Vitamin D and calcium
5) Growth hormone
4) Systemic antibiotics

The anteroposterior and lateral radiographs show thinned cortices and a gentle S-shaped curve of the tibia. The overall alignment of the tibia, as well as the physes, is normal. These are the radiographic features of osteogenesis imperfecta.

In osteogenesis imperfecta, the genetic defect involves type I collagen. Type I collagen is made up of two alpha-1 chains and one alpha-2 chain in a triple helix. Glycine is the smallest amino acid and is crucial for coiling of the triple helix. Mutations in the glycine chain lead to severe forms of osteogenesis imperfecta.

One should also remember the Silence classification:

Type	Inheritance	Sclera	Severity
I	AD	Blue	Mild form, normal teeth
II	AR	Blue	Lethal form, die early
III	AR	Normal	Severe, progressively deforming
IV	AD	Normal	Moderately severe

Biphosphonate therapy can be used to slow bone remodeling and increase bone mass.

Correct Answer: Diphosphonate therapy

791. (2577) Q2-3050:

Slide 1

Slide 2

A 9-year-old boy has a history of multiple fractures. He presents with left leg pain following a minor fall. He has blue sclerae and normal dentition. His anteroposterior (Slide 1) and lateral (Slide 2) plain radiographs are shown. Which of the following is the most likely mode of inheritance of this condition:

1) Autosomal recessive
3) X-linked dominant
2) Autosomal dominant
5) Sporadic mutation, no mendelian pattern
4) X-linked recessive

The anteroposterior and lateral radiographs show thinned cortices and a gentle S-shaped curve of the tibia. The overall alignment of the tibia, as well as the physes, is normal. These are the radiographic features of osteogenesis imperfecta.

In osteogenesis imperfecta, the genetic defect involves type I collagen. Type I collagen is made up of two alpha-1 chains and one alpha-2 chain in a triple helix. Glycine is the smallest amino acid and is crucial for coiling of the triple helix. Mutations in the glycine chain lead to severe forms of osteogenesis imperfecta.

With the blue sclerae and normal dentition, the patient most likely has Silence type I osteogenesis imperfecta, which has an autosomal dominant inheritance pattern.

One should also remember the Silence classification:

Type	Inheritance	Sclera	Severity
I	AD	Blue	Mild form, normal teeth
II	AR	Blue	Lethal form, die early
III	AR	Normal	Severe, progressively deforming
IV	AD	Normal	Moderately severe

Biphosphonate therapy can be used to slow bone remodeling and increase bone mass.

Correct Answer: Autosomal dominant

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792. (2666) Q2-3159:

Which of the following statements is true concerning the use of intra-articular steroids in the treatment of osteoarthritis of the knee in randomized trials:

1) Intra-articular steroids showed no benefit over placebo.
3) Intra-articular steroids were better than placebo at 12 weeks.
2) Intra-articular steroids were better than placebo at 1 to 3 weeks.
5) Intra-articular steroids were less beneficial than placebo at 12 weeks.
4) Intra-articular steroids were less beneficial than placebo at 1 to 3 weeks.

Intra-articular corticosteroid treatment is commonly used in patients with osteoarthritis of the knee.

Randomized trials have shown a significant benefit of corticosteroid injection over placebo at 1 to 3 weeks (in various studies). Using pain as an outcome measure, the benefit is not significant when studied at 6 to 12 weeks.

Correct Answer: Intra-articular steroids were better than placebo at 1 to 3 weeks.

---

793. (2667) Q2-3160:

Which of the following is the most common complication after performing an intra-articular corticosteroid injection in a patient with arthritis:

1) Transient increase in pain
3) Skin depigmentation
2) Infection
5) Flushing and agitation
4) Skin and fat atrophy

A transient increase in pain is the most common complication following an intra-articular injection. The increase in pain is called a flare. The flare usually resolves within 24 hours. The less soluble steroid compounds may precipitate flares more commonly than the more soluble types.

Complications from intra-articular steroid injections are:

1. Transient increase in pain (most common)
    a. In approximately 5%
    b. Subsides within 24 hours
    c. May be caused by the less soluble steroids
2. Skin and subcutaneous tissue atrophy
3. Depigmentation
4. Systemic effects (fairly common)
    a. Usually mild and resolve quickly
    b. Flushing, slight agitation
    c. May worsen glucose control in patients with diabetes
5. Adrenal suppression (when given more than 1 to 2 times per month)
6. Infection occurs in 1 in 10,000 patients

Correct Answer: Transient increase in pain

794. (2703) Q2-3198:

Slide 1

An 80-year-old man has left hip pain with ambulation. A plain radiograph is shown (Slide). The most likely process is:

1) Benign bone neoplasm
3) Metabolic bone disorder
2) Malignant bone neoplasm
5) Bacterial infection
4) Metastatic bone disease

Plain radiographs are the mainstay of diagnosis for Pagetâs disease. Radiographic features include:

- Enlargement and expansion of the bone
- Coarsened trabeculae
- Cortical thickening
- Lucent and sclerotic changes

Notice on this radiograph that there are coarsened trabeculae and bone deformities. A sharp delineation between the cortex and medullary cavity is not present. The cortices have been remodeled, and a small stress fracture in the lateral cortex of the subtrochanteric level is apparent.

This patient has Pagetâs disease, which is a metabolic bone disorder.

Technetium bone scans are sensitive to sites of involvement. Generally, at the time of diagnosis, there is no change in the number of the involved bones.

The serum alkaline phosphatase level is elevated in approximately 95% of patients. Urinary markers of bone turnovers are elevated and include hydroxyproline, N-telopeptide, and deoxypyridinoline.

Bone biopsy is seldom required to make the diagnosis of Pagetâs disease.

Correct Answer: Metabolic bone disorder

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795. (2704) Q2-3199:

Slide 1

An 80-year-old man has left hip pain with ambulation. A plain radiograph is shown (Slide). The cause of this process is most likely:

1) Primary bone malignancy
3) Viral infection
2) Bacterial infection
5) Genetic disorder involving type 1 collagen
4) Vascular insult

Notice on this radiograph that there are coarsened trabeculae and bone deformities. A sharp delineation between the cortex and medullary cavity is not present. The cortices have been remodeled, and a small stress fracture in the lateral cortex of the subtrochanteric level is apparent.

This patient has Pagetâs disease, which is a metabolic bone disorder.

Infection with a paramyxovirus has been implicated in Pagetâs disease. Inclusions that resemble viral nucleocapsid have been found with electron microscopy in the nuclei and cytoplasm of osteoclasts in Pagetâs disease. Controversy exists whether the virus belongs to the measles, canine distemper, or respiratory syncytial viruses.

Correct Answer: Viral infection

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796. (2705) Q2-3200:

Slide 1

An 80-year-old man has left hip pain with ambulation. A plain radiograph is shown (Slide). Which of the following describes the probable inheritance pattern:

1) Autosomal recessive
3) X-linked recessive
2) Austosomal dominant
5) No genetic associations
4) X-linked dominant

Notice on this radiograph that there are coarsened trabeculae and bone deformities. A sharp delineation between the cortex and medullary cavity is not present. The cortices have been remodeled, and a small stress fracture in the lateral cortex of the subtrochanteric level is apparent.

This patient has Pagetâs disease, which is a metabolic bone disorder.

The inheritance pattern of Pagetâs disease is most likely autosomal dominant in pattern. One should remember that a first-degree relative has a seven times greater chance of developing Pagetâs disease than the general population. The exact inheritance is not known although the HLA locus and chromosome 18q (10,11) have been implicated.

Correct Answer: Austosomal dominant

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797. (2706) Q2-3201:

Slide 1

An 80-year-old man has left hip pain with ambulation. A plain radiograph is shown (Slide). Which of the following would not be expected to be elevated in this patient:

1) Urinary total hydroxyproline
3) Serum calcium
2) Serum alkaline phosphatase
5) Urinary deoxypyridinoline
4) Urinary N-telopeptide

Notice on this radiograph that there are coarsened trabeculae and bone deformities. A sharp delineation between the cortex and medullary cavity is not present. The cortices have been remodeled, and a small stress fracture in the lateral cortex of the subtrochanteric level is apparent.

This patient has Pagetâs disease, which is a metabolic bone disorder.

In Pagetâs disease, serum and urinary markers reflect the rate of increased bone turnover â bone resorption and bone formation.

Elevated in active disease:

- Serum alkaline phosphatase
- Serum bone-specific alkaline phosphatase
- Urinary hydroxyproline
- Urinary N-telopeptide of collagen
- Urinary deoxypyridinoline

Note that the serum calcium level is usually normal in Pagetâs disease. However, if a patient is immobilized and has active and extensive Pagetâs disease, then the serum calcium level may become elevated.

Correct Answer: Serum calcium

798. (2707) Q2-3202:

Slide 1

An 80-year-old man has left hip pain with ambulation. A plain radiograph is shown (Slide). Which of the following can be used to treat this disorder:

1) Antiviral agents
3) Interferon alpha
2) Prolonged antibiotic therapy
5) Low-dose cytotoxic chemotherapy
4) Biphosphonates

Notice on this radiograph that there are coarsened trabeculae and bone deformities. A sharp delineation between the cortex and medullary cavity is not present. The cortices have been remodeled, and a small stress fracture in the lateral cortex of the subtrochanteric level is apparent.

This patient has Pagetâs disease, which is a metabolic bone disorder.

Biphosphonate therapy has become the mainstay of treatment. Biphosphonates poison the osteoclast by disturbing the ruffled border. Bone resorption is halted, and the markers of collagen breakdown in the urine markedly diminish.

Correct Answer: Biphosphonates

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799. (2716) Q2-3211:

Which of the following articular cartilage collagens regulates type II collagen fibril diameter:

1) Type I
3) Type V
2) Type III
5) Type XI
4) Type IX

The three types of collagen in articular cartilage are:

1. Type II
    a. 90% to 95% of the total collagen
    b. Highly cross-linked and interconnected
2. Type IX
    a. Forms cross-links with type II
3. Type XI
    a. Regulates the type II fibril diameter

Correct Answer: Type XI

---

800. (2717) Q2-3212:

Which of the following statements concerning type II collagen in articular cartilage is false:

1) Type II collagen comprises 90% to 95% of the articular cartilage.
3) Type IX collagen regulates the type II fiber diameter.
2) The fibers are arranged parallel to the surface in the superficial or tangential zone.
5) The fibers are oriented in a perpendicular fashion in the deep or basal zone.
4) Normally, the collagen turnover is very slow.

The three types of collagen in articular cartilage are:

1. Type II
    a. 90% to 95% of the total collagen
    b. Highly cross-linked and interconnected
2. Type IX
    a. Forms cross-links with type II
3. Type XI
    a. Regulates the type II fibril diameter

In articular cartilage organization:

Cartilage layer	**Collagen fiber arrangement**
Superficial or tangential	Parallel to the surface
Intermediate or transitional	Oblique to the surface
Deep or basal	Perpendicular to the surface

In normal states, the collagen turnover is slow. In contrast, collagen and proteoglycan turnover can be rapid in disease states (such as septic arthritis).

Correct Answer: Type IX collagen regulates the type II fiber diameter.

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801. (2718) Q2-3213:

Which of the following articular cartilage collagens forms cross-links with type II collagen:

1) Type I
3) Type V
2) Type III
5) Type XI
4) Type IX

The three types of collagen in articular cartilage are:

1. Type II
    a. 90% to 95% of the total collagen
    b. Highly cross-linked and interconnected
2. Type IX
    a. Forms cross-links with type II
3. Type XI
    a. Regulates the type II fibril diameter

Correct Answer: Type IX

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802. (2719) Q2-3214:

Which of the following factors has a chondroprotective (anabolic) function:

1) Transforming growth factor beta
3) Interleukin-1
2) Matrix metalloproteinases
5) Cyclooxygenase (COX-2)
4) Tumor necrosis factor alpha

I. Cartilage Metabolism and Regulation

A. Nutrition through diffusion (low oxygen tension, 1% to 2%)
B. Energy through glycolysis
C. Transforming growth factor beta (TGF-B)
    1. Chondroprotective effect
    2. Smad3 which is transcription factor activated by TGF-B also is chondroprotective
D. Insulin-like growth factor increases collagen and proteoglycan synthesis
E. Bone morphogenetic protein (BMP)-2 and BMP-7 increase proteoglycan synthesis and maintain chondrocyte phenotype
F. Interleukin-1
    1. Inhibits proteoglycan synthesis
    2. Stimulates metalloproteinase activity (catabolic enzymes)
G. Tumor necrosis factor alpha
    1. Inhibits collagen synthesis
    2. Stimulates metalloproteinase activity (catabolic enzymes)
H. Other catabolic enzymes
    1. Cyclooxygenase (COX-2)
    2. Nitric oxide synthetase

Chondroprotective (anabolic)	**Chondro-ablative (catabolic)**
TGF-B	Interleukin-1
Smad3	Tumor necrosis factor alpha
Insulin-like growth factor	COX-2
BMP-2	Nitric oxide synthetase
BMP-7	

Correct Answer: Transforming growth factor beta

803. (2720) Q2-3215:

Which of the following has a catabolic effect on articular cartilage:

1) Bone morphogenetic protein (BMP)-2
3) Transforming growth factor beta
2) BMP-7
5) Smad3
4) Tumor necrosis factor alpha

I. Cartilage Metabolism and Regulation

A. Nutrition through diffusion (low oxygen tension, 1% to 2%)
B. Energy through glycolysis
C. Transforming growth factor beta (TGF-B)
    1. Chondroprotective effect
    2. Smad3 which is transcription factor activated by TGF-B also is chondroprotective
D. Insulin-like growth factor increases collagen and proteoglycan synthesis
E. Bone morphogenetic protein (BMP)-2 and BMP-7 increase proteoglycan synthesis and maintain chondrocyte phenotype
F. Interleukin-1
    1. Inhibits proteoglycan synthesis
    2. Stimulates metalloproteinase activity (catabolic enzymes)
G. Tumor necrosis factor alpha
    1. Inhibits collagen synthesis
    2. Stimulates metalloproteinase activity (catabolic enzymes)
H. Other catabolic enzymes
    1. Cyclooxygenase (COX-2)
    2. Nitric oxide synthetase

Chondroprotective (anabolic)	**Chondro-ablative (catabolic)**
TGF-B	Interleukin-1
Smad3	Tumor necrosis factor alpha
Insulin-like growth factor	COX-2
BMP-2	Nitric oxide synthetase
BMP-7	Metalloproteinase

Correct Answer: Tumor necrosis factor alpha

804. (2721) Q2-3216:

Which of the following has a catabolic effect on articular cartilage:

1) Bone morphogenetic protein (BMP)-2
3) Matrix metalloproteinases
2) BMP-7
5) Insulin-like growth factor 1
4) Transforming growth factor beta

I. Cartilage Metabolism and Regulation

A. Nutrition through diffusion (low oxygen tension, 1% to 2%)
B. Energy through glycolysis
C. Transforming growth factor beta (TGF-B)
    1. Chondroprotective effect
    2. Smad3 which is transcription factor activated by TGF-B also is chondroprotective
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Chondroprotective (anabolic)	**Chondro-ablative (catabolic)**
TGF-B	Interleukin-1
Smad3	Tumor necrosis factor alpha
Insulin-like growth factor	COX-2
BMP-2	Nitric oxide synthetase
BMP-7	Metalloproteinase

Correct Answer: Matrix metalloproteinases

805. (2722) Q2-3217:

Which of the following has a catabolic effect on articular cartilage:

1) Bone morphogenetic protein (BMP)-2
3) Smad3
2) BMP-7
5) Cyclooxygenase (COX-2)
4) Insulin-like growth factor 1

I. Cartilage Metabolism and Regulation

A. Nutrition through diffusion (low oxygen tension, 1% to 2%)
B. Energy through glycolysis
C. Transforming growth factor beta (TGF-B)
    1. Chondroprotective effect
    2. Smad3 which is transcription factor activated by TGF-B also is chondroprotective
D. Insulin-like growth factor increases collagen and proteoglycan synthesis
E. Bone morphogenetic protein (BMP)-2 and BMP-7 increase proteoglycan synthesis and maintain chondrocyte phenotype
F. Interleukin-1
    1. Inhibits proteoglycan synthesis
    2. Stimulates metalloproteinase activity (catabolic enzymes)
G. Tumor necrosis factor alpha
    1. Inhibits collagen synthesis
    2. Stimulates metalloproteinase activity (catabolic enzymes)
H. Other catabolic enzymes
    1. Cyclooxygenase (COX-2)
    2. Nitric oxide synthetase

Chondroprotective (anabolic)	**Chondro-ablative (catabolic)**
TGF-B	Interleukin-1
Smad3	Tumor necrosis factor alpha
Insulin-like growth factor	COX-2
BMP-2	Nitric oxide synthetase
BMP-7	Metalloproteinase

Correct Answer: Cyclooxygenase (COX-2)

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806. (2723) Q2-3218:

Which of the following muscle groups comprises the mobile wad of the forearm:

1) Brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevisq
3) Brachioradialis, extensor carpi radialis brevis, extensor pollicis brevis
2) Brachioradialis, extensor pollicis brevis, extensor digitorum communis
5) Extensor carpi ulnaris, extensor pollicis brevis, extensor digitorum communis
4) Brachioradialis, extensor carpi radialis brevis, extensor digitorum communis

The forearm contains the anterior, dorsal, and mobile wad.

The following muscles are located in each compartment:

Mobile wad

- Brachioradialis
- Extensor carpi radialis brevis
- Extensor carpi radialis longus

Volar compartment

- Flexor carpi ulnaris
- Flexor digitorum profundus
- Flexor digitorum superficialis
- Palmaris longus
- Flexor carpi radialis
- Flexor pollicis longus

Correct Answer: Brachioradialis, extensor carpi radialis longus, extensor carpi radialis brevisq

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807. (2724) Q2-3219:

Which of the following muscles must be detached from the tibia when decompressing the deep posterior compartment of the leg:

1) Posterior tibialis
3) Medial gastrocnemius
2) Flexor hallucis longus
5) Flexor digitorum longus
4) Soleus

Of the four compartments, the deep posterior compartment is the most difficult to release. The surgeon must release the soleus muscle from the tibia to decompress the deep posterior compartment.

The tibialis posterior muscle often has its own fascial sheath in the deep posterior compartment. When a surgeon releases the deep posterior compartment, this fascial sheath (if present) should be released.

Correct Answer: Soleus

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808. (2725) Q2-3220:

Which of the following leg muscles often has its own fascial envelope (separate compartment):

1) Anterior tibialis muscle
3) Peroneus longus muscle
2) Posterior tibialis muscle
5) Flexor hallucis longus muscle
4) Flexor digitorum longus muscle

Of the four compartments, the deep posterior compartment is the most difficult to release. The surgeon must release the soleus muscle from the tibia to decompress the deep posterior compartment.

The tibialis posterior muscle often has its own fascial sheath in the deep posterior compartment. When a surgeon releases the deep posterior compartment, this fascial sheath (if present) should be released.

Correct Answer: Posterior tibialis muscle

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809. (2726) Q2-3221:

In patients with a tibia fracture, which of the following compartments are most prone to develop a compartment syndrome:

1) Anterior and lateral
3) Lateral and superficial posterior
2) Anterior and deep posterior
5) Superficial and deep posterior
4) Lateral and deep posterior

In a study by Heckman and colleagues, the level of the fracture site is the region with the highest tissue pressure. This was found to be true in all four components. The highest pressures are located in the anterior and deep posterior components.Correct Answer: Anterior and deep posterior

---

810. (2727) Q2-3222:

The approximate incidence of compartment syndrome following a tibia fracture is:

1) 1% to 2%
3) 10% to 20%
2) 5% to 10%
5) 30% to 40%
4) 20% to 30%

Compartment syndromes occur in approximately 5% to 10% of tibia fractures. Patients with tibia fractures have the highest risk of all fracture patients.

Adult fracture patients at risk for compartment syndrome include (in descending order):

- Tibia shaft fractures
- Femoral shaft fractures
- Both bone forearm fractures
- Distal radius fractures

Children with fractures who are at risk include (in descending order):

- Tibial shaft fractures
- Supracondylar humerus fractures
- Both bone forearm fractures

Correct Answer: 5% to 10%

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811. (2728) Q2-3223:

In patients with a closed tibia fracture and suspected compartment syndrome, the region of the leg that will most likely have the highest tissue pressure measurement is:

1) The middle of the leg
3) At the level of the fracture
2) 5 cm proximal to the fracture site
5) The proximal one-third of the leg
4) 5 cm distal to the fracture site

In a study by Heckman and colleagues, the level of the fracture site is the region with the highest tissue pressure. This was found to be true in all four components. The highest pressures are located in the anterior and deep posterior components.

Correct Answer: At the level of the fracture

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812. (2729) Q2-3224:

Which of the following may be beneficial in decreasing the deleterious effects of total muscle ischemia in a patient who has a compartment syndrome:

1) Systemic steroids
3) Elevation of the extremity above the heart
2) Hypothermia
5) Anticoagulant therapy
4) Antihypertensive therapy

Aside from performing a fasciotomy, little can be done for patients with a compartment syndrome. Hypothermia, systemic corticosteroids, and anticoagulation therapy may increase muscle tolerance to ischemia.

Steroids and anticoagulation are not reasonable options because there is an impaired blood supply to the muscle (ie, these agents cannot enter the muscle). Hypothermia can be used to gain some time if immediate fasciotomy cannot be performed.

Correct Answer: Hypothermia

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813. (2730) Q2-3225:

Which of the following is the most sensitive finding in patients who are at risk for compartment syndrome before total muscle and nerve ischemia occurs:

1) Paresthesia
3) Pain on passive stretch of muscle
2) Loss of peripheral pulses
5) Loss of motor function
4) Delayed capillary refill

Compartment syndromes are difficult to diagnose. It is important to diagnosis compartment syndrome before irreversible muscle and nerve damage occurs.

Pain out of proportion to the injury and pain with passive stretch are the most important subjective and objective findings before a compartment syndrome has fully developed. Pain will subside after a prolonged period of ischemia. The muscle and nerves in the compartment are no longer viable, and the pain will diminish.

Correct Answer: Pain on passive stretch of muscle

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814. (2731) Q2-3226:

Which of the following is the normal resting pressure in skeletal muscle:

1) 0 mm Hg to 8 mm Hg
3) 18 mm Hg to 24 mm Hg
2) 10 mm Hg to 16 mm Hg
5) 30 mm Hg to 36 mm Hg
4) 24 mm Hg to 30 mm Hg

Normal resting muscle tissue pressure is between 0 mm Hg and 8 mm Hg. Remember, if one squeezes the muscle or pushes on it, then the compartment pressure increases.

Normal tissues have adequate tissue perfusion with increases in compartment pressure to within 10 mm Hg of the diastolic pressure. In damaged tissue (eg, tibia fracture), perfusion can be impaired when the diastolic pressure reaches within 20 mm Hg of the diastolic pressure.

One should remember that hypotensive patients with extremity injuries are prone to compartment syndromes.

Correct Answer: 0 mm Hg to 8 mm Hg

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815. (2732) Q2-3227:

In injured tissues, ischemia begins when the tissue pressure within the compartment comes within _____ mm Hg of the diastolic pressure.

1) 10
3) 30
2) 20
5) 50
4) 40

Normal tissues have adequate tissue perfusion with increases in compartment pressure to within 10 mm Hg of the diastolic pressure. In damaged tissue (eg, tibia fracture), perfusion can be impaired when the diastolic pressure reaches within 20 mm Hg of the diastolic pressure.

One should remember that hypotensive patients with extremity injuries are prone to compartment syndromes.

Correct Answer: 20

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816. (2733) Q2-3229:

Complete ischemia of a peripheral nerve results in irreversible damage after _____ hours.

1) 1 to 2 hours
3) 4 to 6 hours
2) 2 to 4 hours
5) 8 to 10 hours
4) 6 to 8 hours

Loss of nerve electrical conduction begins after 2 hours of complete ischemia. Peripheral nerves can tolerate up to 4 hours of complete ischemia. A neurapraxic (loss of conduction capability) injury usually recovers. After 8 hours of complete ischemia, nerves cannot recover.

Patients will lose the sense of pain in a compartment with total ischemia after 2 to 8 hours because there is no conduction to the nerve. One can expect little recovery once this painless state has occurred.

Correct Answer: 8 to 10 hours

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817. (2734) Q2-3230:

Complete muscle ischemia that leads to irreversible muscle damage occurs after which of the following time periods:

1) 1 to 2 hours
3) 4 to 6 hours
2) 2 to 4 hours
5) 8 to 10 hours
4) 6 to 8 hours

Skeletal muscle tolerates periods of complete muscle ischemia for 3 to 4 hours without irreversible damage. Variable recovery occurs with ischemia for 6 to 8 hours. When the period of ischemia is more than 8 hours, there is irreversible muscle damage. After 8 hours, the muscle cells degenerate and, grossly, the muscle contracts as the muscle cells are replaced with scar tissue and contracture may result.

Remember to let a tourniquet down after 2 hours of ischemia. One does not want to enter the tolerance period of 3 to 4 hours.

Correct Answer: 8 to 10 hours

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818. (2735) Q2-3231:

Skeletal muscle may remain viable (electrically responsive) following a period of total ischemia. Which of the following is the correct time interval for the tolerance to total muscle ischemia (complete recovery can be expected):

1) 3 to 4 hours
3) 6 to 8 hours
2) 4 to 6 hours
5) 10 to 12 hours
4) 8 to 10 hours

Skeletal muscle tolerates periods of complete muscle ischemia for 3 to 4 hours without irreversible damage. Variable recovery occurs with ischemia for 6 to 8 hours. When the period of ischemia is more than 8 hours, there is irreversible muscle damage. After 8 hours, the muscle cells degenerate and, grossly, the muscle contracts as the muscle cells are replaced with scar tissue and contracture may result.

Remember to let a tourniquet down after 2 hours of ischemia. One does not want to enter the tolerance period of 3 to 4 hours.

Correct Answer: 3 to 4 hours

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819. (2779) Q2-3277:

Which of the following statements concerning locking plates is true:

1) The pullout strength of a locked unicortical screw is only 30% of a standard bicortical screw.
3) Locked bicortical screws have greater toggle than standard bicortical screws.
2) Toggle between the screws and plate is greater than standard plating.
5) Locked plating is biomechanically similar to external fixation with a lower moment arm.
4) Friction between the plate and cortical bone is greater in locked plating compared to standard plating.

Locking plates have become a popular, effective method of stabilizing metaphyseal/epiphyseal fractures with comminution and short articular fragments.

Important biomechanical features of locking plates include[1]:

- Locked screws can function as individual blade plates in the distal fragment.
- Locking plates can effectively serve as bridge plates, providing excellent fixation in short distal articular fragments.
- Compression of the plate against the bone is less than that of conventional plating, resulting in less devascularization of the underlying cortex.
- There is no toggling between the locked screws and the plate.
- The pullout strength of a locked unicortical screw is approximately 60% of a standard bicortical screw.
- Locking plates are similar biomechanically to an external fixator.
- Moment arms are less because the plate is closer to the bone's neutral axis than the connecting bar of the external fixator.

Correct Answer: Locked plating is biomechanically similar to external fixation with a lower moment arm.

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820. (2780) Q2-3278:

Which of the following statements concerning locking plates is true:

1) The pullout strength of a locked unicortical screw is only 60% of a standard bicortical screw.
3) Locked bicortical screws have greater toggle than standard bicortical screws.
2) Toggle between the screws and plate is greater than standard plating.
5) Locked plating is not biomechanically similar to external fixation with a lower moment arm.
4) Friction between the plate and cortical bone is greater in locked plating compared to standard plating.

Locking plates have become a popular and effective method of stabilizing metaphyseal/epiphyseal fractures with comminution and short articular fragments.

Important biomechanical features of locking plates include:

- locked screws can function as individual blade plates in the distal fragment
- locking plates can effective serve as bridge plates
    - excellent fixation in short distal articular fragments
- compression of the plate against the bone is less than that of conventional plating
    - less devascularization of the underlying cortex
- there is no toggling between the locked screws and the plate
- pullout strength of a locked unicortical screw is approximately 60% a standard bicortical screw
- locking plates are similar biomechanically to an external fixator moment arms are less because the plate is closer to the bone's neutral axis than the connecting bar of the external fixator

Correct Answer: The pullout strength of a locked unicortical screw is only 60% of a standard bicortical screw.

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821. (2781) Q2-3279:

Which of the following describes the inheritance pattern of hemophilia A:

1) Autosomal dominant inheritance
3) Sex-linked dominant
2) Autosomal recessive inheritance
5) Sporadic
4) Sex-linked recessive

Hemophilia A is transmitted by a sex-linked recessive inheritance pattern.

Important points to remember:

- Hemophilia A (classic hemophilia)
  - Factor VIII deficiency
  - Sex-linked recessive trait
  - Incidence - 1/5000 live male births
  - 25% of cases are sporadic (no family history)
- Hemophilia B (Christmas disease)
  - Factor IX deficiency
  - Sex-linked recessive trait
  - Incidence - 1/30,000 live male births

Correct Answer: Sex-linked recessive

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822. (2782) Q2-3280:

Which of the following is the most important pathophysiology factor in hemophilic arthropathy:

1) Viral joint infection
3) Hemosiderin depositionq
2) Bacterial joint infection
5) Neuropathic damage
4) Subchondral bone microfractures

Hemosiderin deposition leads to synovial hypertrophy, bone erosions, recurrent bleeding, and eventual destruction of the articular surfaces and arthrofibrosis.

- Synovial A cells (surface layer phagocytic cells) ingest hemosiderin
- Mixed inflammatory cell population
  - Lymphocytes
  - Plasma cells
  - Histiocytes
- Leads to bone erosion from the thickened synovium

Correct Answer: Hemosiderin depositionq

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823. (2965) Q2-3471:

The âbystander effectâ in cancer gene therapy is:

1) Resistance to gene therapy by neighbor tumor cells after irradiation.
3) The death of neighbor untargeted tumor cells during cell-targeted suicide.
2) The secretion of tumor suppressor cytokines by neighbor cells.
5) None of the above.
4) Anaphylaxis-like side effects seen during tumor gene therapy.

The âbystander effectâ is the death of neighbor untargeted tumor cells during cell-targeted suicide, whereby HSV thymine kinase gene targeted cells commit suicide by absorbing gancyclovir, a prodrug that is turned intracellularly into a toxic metabolite by the targeting gene through phosphorylation.Correct Answer: The death of neighbor untargeted tumor cells during cell-targeted suicide.

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824. (2991) Q2-3497:

Which of the following is associated with cleidocranial dysplasia:

1) Type X collagen
3) Cartilage oligomeric protein
2) Carbonic anhydrase type II, proton pump
5) Core binding factor alpha 1 (Cbfa1)
4) Fibrillin

The defect in cleidocranial dysplasia involves Cbfa1.

- Cbfa1 is a transcription factor (coded by the Cbfa1 gene) that is necessary and sufficient for differentiation of cells into osteoblasts and facilitates chondrocyte differentiation during enchondral bone formation.

The other responses refer to:

- Metaphyseal chondrodysplasia (Schmid type): Type X collagen
- Osteopetrosis: Carbonic anhydrase type II, proton pump
- Metaphyseal epiphyseal dysplasia: Cartilage oligomeric protein
- Marfan's syndrome: Fibrillin

Correct Answer: Core binding factor alpha 1 (Cbfa1)

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825. (2992) Q2-3498:

Which of the following is associated with achondroplasia:

1) Type X collagen
3) Fibrillin
2) Sulfate transporter gene
5) Type I collagen (Col 1A1, 1A2)
4) Fibroblast growth factor 3 (FGF-3) (receptor)

Achondroplasia is caused by a defect in FGF-3 receptor, resulting in an inhibition of chondrocyte proliferation in the proliferative zone of the physis. One possible theory is that this mutation results in a receptor that is active even without binding of the fibroblast growth factor ligand, thereby causing an overactive receptor. This is a gain of function mutation (Dietz).

The other responses refer to:

- Metaphyseal chondrodysplasia (Schmid type): Type X collagen
- Diastrophic dysplasia: Sulfate transporter gene
- Osteogenesis imperfecta: Type I collagen (Col 1A1, 1A2)
- Marfanâs syndrome: Fibrillin

Correct Answer: Fibroblast growth factor 3 (FGF-3) (receptor)

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826. (2993) Q2-3499:

Which of the following defects occurs in Albright hereditary osteodystrophy (pseudohypoparathyroidism):

1) Type X collagen
3) Beta glucosidase
2) Sulfate transporter gene
5) Carbonic anhydrase type II, proton pump
4) Galpha S (GNAS1)

Pseudohypoparathyroidism (PHP) (Albright Hereditary Osteodystrophy [AHO]) - end organ insensitivity; in AHO, germline mutation that leads to loss of function of Galpha S (GNAS1); causes end-organ resistance to PTH (Zaleske).

1. PHP - short stature, short metacarpals (4th and 5th), rounded facies
    a. Mental retardation, tetany
    b. Sex-linked dominant
2. Laboratory features
    a. Hypocalcemia
    b. Hyperphopshatemia
    c. Normal PTH
3. Other features

The other responses refer to:

- Metaphyseal chondrodysplasia (Schmid type): Type X collagen
- Diastrophic dysplasia: Sulfate transporter gene
- Gaucher's disease: Beta glucosidase
- Osteopetrosis: Carbonic anhydrase type II, proton pump

Correct Answer: Galpha S (GNAS1)

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827. (2994) Q2-3500:

Which of the following is associated with Marfan's syndrome:

1) Sulfate transporter gene
3) Carbonic anhydrase type II, proton pump
2) Fibroblast growth factor 3 (FGF-3) (receptor)
5) Fibrillin
4) Core binding factor alpha 1 (Cbfa1)

The defective gene (located on chromosome 15) in Marfan's syndrome encodes for fibrillin. Fibrillin is a structural component of elastin and contains microfibrils (Dietz).

Features of Marfan's syndrome include:

- Long, thin limbs (dolichostenomelia)
- Pectus excavatum, carinatum
- Scoliosis
- High and narrow palate
- Ectopia lentis
- Dilation of the ascending aorta
- Dural ectasia

The other responses refer to:

- Achondroplasia: FGF-3 receptor
- Diastrophic dysplasia: Sulfate transporter gene
- Cleidocranial dysplasia: Cbfa1
- Osteopetrosis: Carbonic anhydrase type II, proton pump

Correct Answer: Fibrillin

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828. (3003) Q2-3509:

Which of the following proteins binds to osteoclast precursor cells and positively effects their final differentiation into osteoclasts:

1) Receptor activator of nuclear factor-*k*B (RANK)
3) Bone morphogenetic protein-7
2) Osteoprotegerin
5) Parathyroid hormone related protein (PTHrP)
4) Core binding factor alpha 1 (Cbfa1)

Four proteins that regulate osteoclast activation have been discovered:

1. RANK binds to a receptor on osteoclast precursor cells and positively effects their final differentiation into osteoclasts.
2. Osteoprotegerin is a soluble decoy receptor that resembles RANK and inhibits osteoclasts.
3. Tumor necrosis factor-related activation induced cytokine (TRANCE)
4. Osteoclast differentiation factor

Note:

- Cbfa1 is a transcription factor (coded by the Cbfa1 gene) that is necessary and sufficient for differentiation of cells into osteoblasts and facilitates chondrocyte differentiation during enchondral bone formation.

Correct Answer: Receptor activator of nuclear factor-*k*B (RANK)

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829. (3004) Q2-3510:

Which of the following proteins negatively affects osteoclast precursor cells:

1) Receptor activator of nuclear factor-*k*B (RANK)
3) Bone morphogenetic protein-7
2) Osteoprotegerin
5) Parathyroid hormone related protein (PTHrP)
4) Core binding factor alpha 1 (Cbfa1)

Four proteins that regulate osteoclast activation have been discovered:

1. RANK binds to a receptor on osteoclast precursor cells and positively effects their final differentiation into osteoclasts.
2. Osteoprotegerin is a soluble decoy receptor that resembles RANK and inhibits osteoclasts.
3. Tumor necrosis factor-related activation induced cytokine (TRANCE)
4. Osteoclast differentiation factor

Note:

- Cbfa1 is a transcription factor (coded by the Cbfa1 gene) that is necessary and sufficient for differentiation of cells into osteoblasts and facilitates chondrocyte differentiation during enchondral bone formation.

Correct Answer: Osteoprotegerin

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830. (3005) Q2-3511:

Which of the following proteins or genes is necessary for bone formation and induces osteocalcin:

1) *Sox-9* gene
3) Tumor necrosis factor-related activation induced cytokine
2) Receptor activator of nuclear factor-*k*B protein
5) Core binding factor alpha 1 (*Cbfa1*) gene
4) Osteoprotegerin

Core binding factor alpha 1 (Cbfa1) and its gene (*Cbfa1*) have been described as anabolic regulators of bone. Cbfa1 is a transcription factor and is responsible for the differentiation of precursor cells into osteoblasts. It also enhances differentiation of chondrocytes during enchondral bone formation. When there is deficiency of Cbfa1, there can be abnormal bone development as in cleidocranial dysplasia.

Correct Answer: Core binding factor alpha 1 (*Cbfa1*) gene

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831. (3006) Q2-3512:

The human genome is comprised of approximately how many genes:

1) 1,000
3) 10,000
2) 5,000
5) 100,000
4) 30,000

The human genome is composed of 30,000 unique genes. Each gene is composed of a promotor or regulator region, and a transcriptional or coding region. Regulatory proteins or transcription factors bind to the promoter region of the gene to signal the beginning of transcription of the DNA into RNA or repress the expression of the gene. The coding region contains both introns and exons. Exon sequences of the gene directly code for the proteins, and the introns are spacers. The intron sequences are enzymatically removed from the newly transcribed messenger RNA by a splicing mechanism.

Correct Answer: 30,000

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832. (3007) Q2-3513:

Which of the following portions of a gene directly codes for the messenger RNA for eventual translation into proteins on the ribosome:

1) Promoter region
3) Exon
2) Intron
5) Activator or repressor binding site
4) Coding region

The human genome is composed of 30,000 unique genes. Each gene is composed of a promotor or regulator region, and a transcriptional or coding region. Regulatory proteins or transcription factors bind to the promoter region of the gene to signal the beginning of transcription of the DNA into RNA or repress the expression of the gene. The coding region contains both introns and exons. Exon sequences of the gene directly code for the proteins, and the introns are spacers. The intron sequences are enzymatically removed from the newly transcribed messenger RNA by a splicing mechanism.

Correct Answer: Exon

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833. (3008) Q2-3514:

Which of the following describes the inheritance pattern of achondroplasia:

1) X-linked recessive
3) Autosomal dominant
2) Sporadic
5) X-linked dominant
4) Autosomal recessive

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-dominant conditions:

- **Achondroplasia**
- Spondyloepiphyseal dysplasia
- Multiple epiphyseal dysplasia
- Marfan's syndrome
- Ehlers-Danlos syndrome
- Osteogenesis imperfecta (I, IV)
- Multiple hereditary exostosis
- Polydactyly

Correct Answer: Autosomal dominant

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834. (3009) Q2-3515:

Which of the following describes the inheritance pattern of Marfanâs syndrome:

1) Autosomal recessive
3) X-linked recessive
2) Autosomal dominant
5) Sporadic
4) X-linked dominant

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-dominant conditions:

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- Spondyloepiphyseal dysplasia
- Multiple epiphyseal dysplasia
- **Marfan's syndrome**
- Ehlers-Danlos syndrome
- Osteogenesis imperfecta (I, IV)
- Multiple hereditary exostosis
- Polydactyly

Correct Answer: Autosomal dominant

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835. (3010) Q2-3516:

Which of the following describes the inheritance pattern of Ehlers-Danlos syndrome:

1) Autosomal recessive
3) X-linked recessive
2) Autosomal dominant
5) Sporadic
4) X-linked dominant

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-dominant conditions:

- Achondroplasia
- Spondyloepiphyseal dysplasia
- Multiple epiphyseal dysplasia
- Marfan's syndrome
- **Ehlers-Danlos syndrome**
- Osteogenesis imperfecta (I, IV)
- Multiple hereditary exostosis
- Polydactyly

Correct Answer: Autosomal dominant

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836. (3011) Q2-3517:

Which of the following describes the inheritance pattern of multiple hereditary exostoses:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-dominant conditions:

- Achondroplasia
- Spondyloepiphyseal dysplasia
- Multiple epiphyseal dysplasia
- Marfan's syndrome
- Ehlers-Danlos syndrome
- Osteogenesis imperfecta (I, IV)
- **Multiple hereditary exostosis**
- Polydactyly

Correct Answer: Autosomal dominant

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837. (3012) Q2-3518:

Which of the following describes the inheritance pattern of polydactyly:

1) Autosomal recessive
3) X-linked recessive
2) Autosomal dominant
5) Sporadic
4) X-linked dominant

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-dominant conditions:

- Achondroplasia
- Spondyloepiphyseal dysplasia
- Multiple epiphyseal dysplasia
- Marfan's syndrome
- Ehlers-Danlos syndrome
- Osteogenesis imperfecta (I, IV)
- Multiple hereditary exostosis
- **Polydactyly**

Correct Answer: Autosomal dominant

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838. (3013) Q2-3519:

Which of the following describes the inheritance pattern of hypophosphatasia:

1) Austosomal dominant
3) X-linked dominant
2) Austosomal recessive
5) Sporadic
4) X-linked recessive

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-recessive conditions:

- Sickle cell disease
- Osteogenesis imperfecta (Types II, III)
- Hypophosphatasia
- Homocystinuria
- Gaucher's disease

Correct Answer: Austosomal recessive

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839. (3014) Q2-3520:

Which of the following describes the inheritance pattern of sickle cell disease:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-recessive conditions:

- Sickle cell disease
- Osteogenesis imperfecta (Types II, III)
- Hypophosphatasia
- Homocystinuria
- Gaucher's disease

Correct Answer: Autosomal recessive

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840. (3015) Q2-3521:

Which of the following describes the inheritance pattern of Gaucher's disease:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-recessive conditions:

- Sickle cell disease
- Osteogenesis imperfecta (Types II, III)
- Hypophosphatasia
- Homocystinuria
- Gaucher's disease

Correct Answer: Autosomal recessive

841. (3016) Q2-3522:

Which of the following describes the inheritance pattern of homocystinuria:

1) Autosomal recessive
3) X-linked recessive
2) Autosomal dominant
5) Sporadic
4) X-linked dominant

Structural defects are usually transmitted by an autosomal-dominant pattern. In contrast, with metabolic or enzyme deficiencies, the condition is usually transmitted in an autosomal-recessive pattern.

Remember the major autosomal-recessive conditions:

- Sickle cell disease
- Osteogenesis imperfecta (Types II, III)
- Hypophosphatasia
- Homocystinuria
- Gaucher's disease

Correct Answer: Autosomal recessive

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842. (3017) Q2-3523:

Which of the following describes the inheritance pattern for hypophosphatemic rickets:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Common inheritance patterns that should be known for examinations:

Autosomal dominant	*Autosomal recessive*	*X-linked dominant*	*X-linked recessive*
Achondroplasia	Sickle cell	Hypophosphatemic rickets	Hemophilia (A, B)
SED (congenital)	OI (II, III)		Duchennes muscular dystrophy
MED	Hypophosphatasia		Hunters syndrome
Marfanâs syndrome	Homocystinuria		SED (tarda)
Ehlers-Danlos syndrome	Gaucherâs disease		Beckerâs muscular dystrophy

Abbreviations: OI (I,IV)=Osteogenesis imperfecta, SED=Spondyloepiphyseal dysplasia, MED=Multiple epiphyseal dysplasia, MHE=Multiple hereditary exostosis

Correct Answer: X-linked dominant

843. (3018) Q2-3524:

Which of the following describes the inheritance pattern for hemophilia A:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Common inheritance patterns are shown in the Table below:

Autosomal dominant	*Autosomal recessive*	*X-linked dominant*	*X-linked recessive*
Achondroplasia	Sickle cell	Hypophosphatemic rickets	Hemophilia (A, B)
SED (congenital)	OI (II, III)		Duchennes muscular dystrophy
MED	Hypophosphatasia		Hunters syndrome
Marfanâs syndrome	Homocystinuria		SED (tarda)
Ehlers-Danlos syndrome	Gaucherâs disease		Beckerâs muscular dystrophy

Abbreviations: OI (I,IV)=Osteogenesis imperfecta, SED=Spondyloepiphyseal dysplasia, MED=Multiple epiphyseal dysplasia, MHE=Multiple hereditary exostosis

Correct Answer: X-linked recessive

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844. (3019) Q2-3525:

Which of the following describes the inheritance pattern of Duchennes muscular dystrophy:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Common inheritance patterns that should be known for examinations:

Autosomal dominant	*Autosomal recessive*	*X-linked dominant*	*X-linked recessive*
Achondroplasia	Sickle cell	Hypophosphatemic rickets	Hemophilia (A, B)
SED (congenital)	OI (II, III)		Duchennes muscular dystrophy
MED	Hypophosphatasia		Hunters syndrome
Marfanâs syndrome	Homocystinuria		SED (tarda)
Ehlers-Danlos syndrome	Gaucherâs disease		Beckerâs muscular dystrophy

Abbreviations: OI (I,IV)=Osteogenesis imperfecta, SED=Spondyloepiphyseal dysplasia, MED=Multiple epiphyseal dysplasia, MHE=Multiple hereditary exostosis

Correct Answer: X-linked recessive

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845. (3020) Q2-3526:

Which of the following describes the inheritance pattern of Becker's muscular dystrophy:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Sporadic
4) X-linked recessive

Common inheritance patterns that should be known for examinations:

Autosomal dominant	*Autosomal recessive*	*X-linked dominant*	*X-linked recessive*
Achondroplasia	Sickle cell	Hypophosphatemic rickets	Hemophilia (A, B)
SED (congenital)	OI (II, III)		Duchennes muscular dystrophy
MED	Hypophosphatasia		Hunters syndrome
Marfanâs syndrome	Homocystinuria		SED (tarda)
Ehlers-Danlos syndrome	Gaucherâs disease		Beckerâs muscular dystrophy

Abbreviations: OI (I,IV)=Osteogenesis imperfecta, SED=Spondyloepiphyseal dysplasia, MED=Multiple epiphyseal dysplasia, MHE=Multiple hereditary exostosis

Correct Answer: X-linked recessive

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846. (3021) Q2-3527:

Which of the following conditions is transmitted by an X-linked dominant inheritance pattern:

1) Hemophilia A
3) Duchennes muscular dystrophy
2) Hypophosphatemic rickets
5) Hypophosphatasia
4) Achondroplasia

There is only one condition that must be remembered for examinations that is transmitted through an X-linked dominant pattern - hypophosphatemic rickets.

Remember: the conditions which are x-linked recessive

- Hemophilia A, B - X-linked recessive
- Duchennes muscular dystrophy - X-linked recessive
- Achondroplasia - Autosomal dominant
- Hypophosphatasia - Autosomal recessive

Correct Answer: Hypophosphatemic rickets

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847. (3022) Q2-3528:

Which of the following conditions is transmitted by an autosomal-dominant pattern:

1) Hemophilia A
3) Hypophosphatemic rickets
2) Achondroplasia
5) Hypophosphatasia
4) Duchennes muscular dystrophy

Achondroplasia has an autosomal-dominant pattern of inheritance. Structural problems are usually transmitted via autosomal-dominant pattern.

If an affected individual is married to an unaffected person, then the chance of transmission to the children is 50%.

The other conditions have the following transmission pattern:

- Hemophilia A, B - X-linked recessive
- Duchennes muscular dystrophy - X-linked recessive
- Achondroplasia - Autosomal dominant
- Hypophosphatasia - Autosomal recessive

Correct Answer: Achondroplasia

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848. (3023) Q2-3529:

A man with an autosomal-dominant condition married a woman without the condition. What is the probability that one of the offspring will be affected:

1) 0%
3) 50%
2) 25%
5) 100%
4) 75%

For autosomal dominant, if one parent is a heterozygote and the other is normal, then the risk of transmission is to 50% of the offspring. Because of the dominance of the allele, heterozygotes manifest the condition.

For autosomal recessive, parents are usually not affected because they are heterozygotes. The risk of transmission is to 25% of the offspring. The children must have both recessive alleles to be affected.

Correct Answer: 50%

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849. (3024) Q2-3530:

A man with a single autosomal-recessive gene marries a woman who does not carry the recessive gene. The chance of one of the children expressing the phenotype of the recessive gene is:

1) 0%
3) 50%
2) 25%
5) 100%
4) 75%

For autosomal dominant, if one parent is a heterozygote and the other is normal, then the risk of transmission is to 50% of the offspring. Because of the dominance of the allele, heterozygotes manifest the condition.

For autosomal recessive, parents are usually not affected because they are heterozygotes. The risk of transmission is to 25% of the offspring. The children must have both recessive alleles to be affected.

Because only one parent contains the gene, none of the children will be affected, although 25% of the children will carry the recessive gene.

Correct Answer: 0%

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850. (3025) Q2-3531:

A man with a single autosomal-recessive gene marries a woman who does not carry the recessive gene. The chance of one of the children carrying the recessive gene is:

1) 0%
3) 50%
2) 25%
5) 100%
4) 75%

For autosomal dominant, if one parent is a heterozygote and the other is normal, then the risk of transmission is to 50% of the offspring. Because of the dominance of the allele, heterozygotes manifest the condition.

For autosomal recessive, parents are usually not affected because they are heterozygotes. The risk of transmission is to 25% of the offspring. The children must have both recessive alleles to be affected.

Because only one parent contains the gene, none of the children will be affected, although 25% of the children will carry the recessive gene.

Correct Answer: 25%

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851. (3026) Q2-3532:

A man has an X-linked dominant condition and marries a woman who does not carry the abnormal gene. Which of the following is true concerning the offspring:

1) 50% of the daughters will be affected
3) 50% of the sons will be affected
2) 100% of the daughters will be affected
5) 25% of the sons and daughters will be affected
4) 100% of the sons will be affected

With X-linked dominant, heterozygotes will have the condition. If a woman has this condition, then she will transmit it to 50% of her sons and daughters.

In contrast, affected men transmit the condition to all of his daughters (because the daughter gets his X chromosome), but to none of the sons because the son gets the Y chromosome.

With X-linked recessive, the patterns are different between women and men.

X-linked recessive woman: An X-linked woman with the recessive allele is a carrier, but she is not affected because the allele is recessive.

Carrier females (X-linked recessive) transmit the condition to 50% of her daughters (who become carriers) and 50% of her sons (the sons are affected because their only X chromosome has the recessive gene).

Correct Answer: 100% of the daughters will be affected

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852. (3027) Q2-3533:

A woman has an X-linked dominant condition (single allele being dominant). Which of the following is true:

1) 25% of the offspring will be affected
3) 25% of the sons will be affected
2) 100% of the daughters will be affected
5) 50% of the offspring will be affected
4) 100% of the sons will be affected

With X-linked dominant, heterozygotes will have the condition. If a woman has this condition, then she will transmit it to 50% of her sons and daughters.

In contrast, affected men transmit the condition to all of his daughters (because the daughter gets his X chromosome), but to none of the sons because the son gets the Y chromosome.

With X-linked recessive, the patterns are different between women and men.

X-linked recessive woman: An X-linked woman with the recessive allele is a carrier, but she is not affected because the allele is recessive.

Carrier females (X-linked recessive) transmit the condition to 50% of her daughters (who become carriers) and 50% of her sons (the sons are affected because their only X chromosome has the recessive gene).

Correct Answer: 50% of the offspring will be affected

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853. (3028) Q2-3535:

Which of the following are actions of parathyroid hormone (PTH):

1) Increases kidney absorption of calcium and increases kidney absorption of phosphate
3) Directly activates osteoclast precursor cells to differentiate into osteoclasts
2) Increases kidney absorption of calcium and decreases kidney absorption of phosphate
5) Causes increased production of calcium binding protein
4) Decreases 1 alpha hydroxylase activity in the kidney

Parathyroid hormone increases calcium reabsorption from the kidney tubular cells and inhibits the reabsorption of phosphate.

Remember that PTH signals the osteoblasts to release receptor activator of nuclear factor -*k*B ligand (RANKL), which causes osteoclast activation â this is an indirect action.

PTH actions:

- Facilitates absorption of calcium in the gastrointestinal system
  - Increases 1,25 dihydroxy vitamin D in the kidney by stimulating 1 alpha hydroxylase
- Facilitates reabsorption of calcium from the distal tubular renal tubular cells
  - Calcium is reabsorbed in the proximal and distal tubules, but only distal tubule is PTH dependent
- Inhibits reabsorption of phosphate in the kidney
- Stimulates release of calcium and phosphate from bone (indirectly)
  - Causes release of receptor activator of nuclear factor -*k*B ligand (RANKL) from the surface of the osteoblasts

Correct Answer: Increases kidney absorption of calcium and decreases kidney absorption of phosphate

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854. (3029) Q2-3536:

Which of the following cells has receptors for parathyroid hormone (PTH):

1) Osteoblasts, osteoclasts, and distal kidney nephron
3) Osteoclasts and osteoclast progenitor cells
2) Osteoblasts, osteoclasts, and gastrointestinal cells
5) Osteoclast progenitor cells
4) Osteoblasts and distal kidney nephron

PTH actions:

- Facilitates absorption of calcium in the gastrointestinal system
  - Increases 1,25 dihydroxy vitamin D in the kidney by stimulating 1 alpha hydroxylase
- Facilitates reabsorption of calcium from the distal tubular renal tubular cells
  - Calcium is reabsorbed in the proximal and distal tubules, but only distal tubule is PTH dependent
- Inhibits reabsorption of phosphate in the kidney
- Stimulates release of calcium and phosphate from bone (indirectly)
  - Causes release of receptor activator of nuclear factor -*k*B ligand (RANKL) from the surface of the osteoblasts

Parathyroid hormone exerts its affects through receptors on osteoblasts and kidney nephron cells. Parathyroid hormone effects on the gut are indirect through an increased synthesis of 1,25 dihydroxy vitamin D. Parathyroid hormone acts on osteoblasts to release RANKL, which then acts on the osteoclast progenitor cells to differentiate into osteoclasts.

Correct Answer: Osteoblasts and distal kidney nephron

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855. (3030) Q2-3537:

Which of the following is an action of 1,25 dihydroxy vitamin D:

1) Increases synthesis of calcium binding protein
3) Increases bone resorption by directly signaling osteoclasts
2) Causes kidney tubule cells to absorb calcium
5) Causes kidney tubule cells to absorb phosphorus
4) Increases parathyroid hormone (PTH) production

Vitamin D acts on the intestinal to increase calcium absorption. Calcium binding protein synthesis is increased. Vitamin D is an intracellular messenger, acting through the nucleus.

Vitamin D actions:

- Increase the efficiency of calcium absorption in the intestine (primarily duodenum)
  - Increases synthesis of calcium binding protein (and others)
  - Increases passage of calcium through the cell membrane
  - Moves calcium through the cell cytoplasm and into the circulation
- Increases bone resorption by telling the osteoblasts to release receptor activator of nuclear factor -*k*B ligand
- Osteoblasts have vitamin D receptors
- Vitamin D receptors exert a negative feedback on 1,25 dihydroxy vitamin D production
- Decreases PTH production

Correct Answer: Increases synthesis of calcium binding protein

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856. (3031) Q2-3538:

Which of the following cause the release of receptor activator of nuclear factor -*k*B ligand (RANKL) from the osteoblast cell surface:

1) Osteoprotegerin
3) Insulin-like growth factor
2) Transforming growth factor beta
5) Calcitonin
4) Parathyroid hormone (PTH) receptor

Osteoclast progenitor cells are activated to transform into osteoclasts when the RANKL activates the RANK receptor.

The following factors cause release of RANKL from the osteoblast:

- PTH
- 1,25 dihydroxy vitamin D
- Interleukin 11
- Prostaglandin E2

Correct Answer: Parathyroid hormone (PTH) receptor

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857. (3032) Q2-3539:

Which of the following cause the release of receptor activator of nuclear factor -*k*B ligand (RANKL) from the osteoblast cell surface:

1) Calcitonin
3) Transforming growth factor B
2) 1,25 dihydroxy vitamin D
5) Tumor necrosis factor
4) Insulin-like growth factor

Osteoclast progenitor cells are activated to transform into osteoclasts when the RANKL activates the RANK receptor.

The following factors cause release of RANKL from the osteoblast:

- PTH
- 1,25 dihydroxy vitamin D
- Interleukin 11
- Prostaglandin E2

Correct Answer: 1,25 dihydroxy vitamin D

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858. (3033) Q2-3540:

Calcitonin has which of the following functions:

1) Inhibits the release of receptor activator of nuclear factor -*k*B ligand (RANKL) from the surface of osteoblasts
3) Causes osteoclasts to withdraw from the bone surface
2) Increases the release of osteoprotegerin from the surface of osteoblasts
5) Causes a decrease in conversion of 25 hydroxy vitamin D into 1,25 dihydroxy vitamin D
4) Causes a decrease in conversion of vitamin D into 25 hydroxy vitamin D

Calcitonin has 1 major action:

- Inhibits osteoclastic bone resorption â the osteoclast shrinks and withdraws from the bone surface

Calcitonin can be used in the following conditions:

- Paget's disease
- Osteoporosis
- Hypercalcemia of malignancy

Calcitonin is used less frequently today than in the past. Diphosphonate agents are the main therapeutic agents.

Correct Answer: Causes osteoclasts to withdraw from the bone surface

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859. (3034) Q2-3541:

Which of the following soft tissue tumors may cause tumor-induced osteomalacia:

1) Liposarcoma
3) Synovial sarcoma
2) Malignant fibrous histiocytoma
5) Atypical lipoma
4) Hemangiopericytoma

Tumor-induced osteomalacia can be caused by a small tumor of bone or soft tissue (phosphaturic tumor). Small tumors may not be detected.

I. General Features

A. Presentation
    1. Chronic, vague symptoms - principally, bone pain
    2. Muscle weakness
    3. Fractures may occur
B. Metabolic profile
    1. Hypophosphatemia
    2. Low reabsorption of phosphate from the kidney
    3. 1,25 dihydroxy vitamin D - low or normal
    4. 25 hydroxy vitamin D, 24,25 dihydroxy vitamin D - normal
C. Tumor types
    1. Soft tissue
        a. Hemangiopericytoma
        b. Sclerosing angioma
        c. Benign angiofibroma
        d. Neurofibromatosis
D. Pathophysiology
    1. A molecule that wastes phosphorus - phosphatonin
E. Radiographic features
    1. Osteopenia
    2. Pseudofractures
    3. Coarsened trabeculae
    4. Soft tissue - a small, well-circumscribed soft tissue mass may be noted
F. Treatment
    1. Oral phosphate
    2. 1,25 dihydroxy vitamin D

Correct Answer: Hemangiopericytoma

860. (3035) Q2-3542:

Which of the following bone tumors may cause tumor-induced osteomalacia:

1) Osteosarcoma
3) Osteoblastoma
2) Ewing's sarcoma
5) Malignant fibrous histiocytoma
4) Adamantinoma

Tumor-induced osteomalacia can be caused by a small tumor of bone or soft tissue (phosphaturic tumor). Small tumors may not be detected.

I. General Features

A. Presentation
    1. Chronic, vague symptoms - principally, bone pain
    2. Muscle weakness
    3. Fractures may occur
B. Metabolic profile
    1. Hypophosphatemia
    2. Low reabsorption of phosphate from the kidney
    3. 1,25 dihydroxy vitamin D - low or normal
    4. 25 hydroxy vitamin D, 24,25 dihydroxy vitamin D - normal
C. Tumor types
    1. Bone
        a. Nonossifying fibroma
        b. Osteoblastoma
        c. Giant cell tumor
        d. Fibrous dysplasia
D. Pathophysiology
    1. A molecule is produced by the tumor that wastes phosphorus - phosphatonin
E. Radiographic features
    1. Osteopenia
    2. Pseudofractures
    3. Coarsened trabeculae
    4. Soft tissue - a small, well-circumscribed soft tissue mass may be noted
F. Treatment
    1. Oral phosphate
    2. 1,25 dihydroxy vitamin D

Correct Answer: Osteoblastoma

861. (3036) Q2-3543:

Which of the following would be the metabolic profile for a patient with tumor-induced osteomalacia:

1) Low serum calcium, low serum phosphate
3) Normal serum calcium, low serum phosphate
2) Low serum calcium, high serum phosphate
5) High serum calcium, low serum phosphate
4) Normal serum calcium, high serum phosphate

I. General Features

A. Presentation
   1. Chronic, vague symptoms - principally, bone pain
   2. Muscle weakness
   3. Fractures may occur

B. Metabolic profile
   1. Hypophosphatemia
   2. Low reabsorption of phosphate from the kidney
   3. 1,25 dihydroxy vitamin D - low or normal
   4. 25 hydroxy vitamin D, 24,25 dihydroxy vitamin D - normal

C. Pathophysiology
   1. A molecule is produced by the tumor that wastes phosphorus - phosphatonin

D. Radiographic features
   1. Osteopenia
   2. Pseudofractures
   3. Coarsened trabeculae
   4. Soft tissue - a small, well-circumscribed soft tissue mass may be noted

E. Treatment
   1. Oral phosphate
   2. 1,25 dihydroxy vitamin D

Correct Answer: Normal serum calcium, low serum phosphate

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862. (3037) Q2-3544:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

In a patient with metabolic bone disease, which of the above metabolic patterns is most likely vitamin D-deficient rickets:

1) Scenario 1
3) Scenario 3
2) Scenario 2
5) Scenario 5
4) Scenario 4

In patients with vitamin D-deficient rickets, a low amount of vitamin D is present in the diet. Because of a low calcium level in patients with vitamin D deficiency, patients develop secondary hyperparathyroidism.

The increased parathyroid hormone (PTH) causes increased absorption of calcium from the small intestine and decreased absorption of phosphorus from the kidney. Therefore, serum calcium is low or normal, serum phosphate is decreased, and PTH is high. Increased bone resorption occurs, and 25 hydroxy and 1,25 dihydroxy vitamin D are low.

Patients are treated with supplemental vitamin D in their diet.

Correct Answer: Scenario 1

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863. (3038) Q2-3545:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

In a patient with metabolic bone disease, which of the above scenarios would be consistent with dietary phosphate deficiency:

1) Scenario 1
3) Scenario 3
2) Scenario 2
5) Scenario 5
4) Scenario 4

Dietary phosphate deficiency is rare. Patients have a normal serum calcium and parathyroid hormone level, and the vitamin D levels are also normal. Because of an insufficient amount of phosphate, normal bone mineralization does not occur.

Patients are treated with supplemental neutral phosphate.

Correct Answer: Scenario 2

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864. (3039) Q2-3546:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

A patient has gastrointestinal surgery and develops osteomalacia (rickets). Which of the above scenarios would be the most likely metabolic panel:

1) Scenario 1
3) Scenario 3
2) Scenario 2
5) Scenario 5
4) Scenario 4

Patients who have gastrointestinal surgery or have gastrointestinal disease (eg, Crohn's disease) may develop osteomalacia. The metabolic parameters are similar to that seen with dietary vitamin D deficiency â a low calcium level and resulting hyperparathyroidism.

Calcium is poorly absorbed or a steatorrhea is present, which binds the calcium so that it cannot be well absorbed. Because of a low calcium level, patients develop secondary hyperparathyroidism.

The increased parathyroid hormone (PTH) causes increased absorption of calcium from the small intestine and decreased absorption of phosphorus from the kidney. Therefore, serum calcium is low or normal, serum phosphate is decreased, and PTH is high. Increased bone resorption occurs, and 25 hydroxy and 1,25 dihydroxy vitamin D are low.

Correct Answer: Scenario 1

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865. (3040) Q2-3547:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

A patient has phosphate diabetes (vitamin D-resistant rickets). Which of the above metabolic profiles would most likely result:

1) Scenario 1
3) Scenario 4
2) Scenario 3
5) Scenario 7
4) Scenario 6

Phosphate diabetes is a type of vitamin D-resistant rickets. Patients are unable to reabsorb phosphate in the kidney tubules. The serum phosphate level is low, and patients are unable to mineralize osteiod because of the low phosphate. Serum calcium, parathyroid hormone, and vitamin D levels are normal. Patients are treated with large amounts of neutral phosphate in the diet.

Patients are resistant to vitamin D because of their inability to reabsorb phosphate in the kidney tubules.

Correct Answer: Scenario 3

866. (3041) Q2-3548:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

Which of the above metabolic profiles occurs in a patient who had vitamin D-resistant rickets with the inability to produce adequate amounts of the 1,25 dihydroxy vitamin D:

1) Scenario 3
3) Scenario 5
2) Scenario 4
5) Scenario 7
4) Scenario 6

Vitamin D-resistant rickets may occur when there is an inability to convert 25 hydroxy vitamin D into 1,25 dihydroxy vitamin D.

Patients develop secondary hyperparathyroidism. A low serum calcium level causes an increased parathyroid hormone (PTH) level. Parathyroid hormone causes the kidneys not to reabsorb phosphorus, and the serum phosphate is low. The serum 1,25 dihydroxy vitamin D level is low.

The metabolic profile is:

Serum calcium	Low
Serum phosphate	Low
Serum PTH	High
25 vitamin D	Normal
1,25 vitamin D	Very low

Treatment is by dietary 1,25 dihydroxy vitamin D.

Correct Answer: Scenario 4

867. (3042) Q2-3549:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	L	H	H	L	L	L

Which of the above metabolic profiles occurs in a patient with vitamin D-resistant rickets with end-organ insensitivity to 1,25 dihydroxy vitamin D:

1) Scenario 3
3) Scenario 5
2) Scenario 4
5) Scenario 7
4) Scenario 6

One form of vitamin D-resistant rickets is end-organ insensitivity to 1,25 dihydroxy vitamin D. The small intestine gastrointestinal cells are not able to respond to 1,25 dihydroxy vitamin D. The serum calcium is low, and patients develop secondary hyperparathyroidism - high serum parathyroid hormone (PTH). The high serum PTH causes the kidneys not to reabsorb phosphate so that the serum phosphate level is low.

The metabolic profile is:

Serum calcium	Low
Serum phosphate	Low
Serum PTH	High
25 vitamin D	Normal or high
1,25 vitamin D	Normal or high

Treatment is difficult; some patients with mild involvement are treated with vitamin D, and patients with severe disease may require calcium infusions.

Correct Answer: Scenario 7

868. (3043) Q2-3550:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

Which of the above metabolic profiles occurs in a patient with renal tubular acidosis:

1) Scenario 3
3) Scenario 5
2) Scenario 4
5) Scenario 7
4) Scenario 6

In patients with renal tubular acidosis, the kidney has to secrete a positive ion (Na, Ca) to balance the pH. The secretion of calcium ions results in ostomalacia or rickets as there is insufficient calcium to mineralize newly formed osteiod.

With low serum calcium levels, the serum parathyroid hormone (PTH) level increases, causing decreased reabsorption of phosphate. Vitamin levels are normal. Renal tubular acidosis is the only condition in which there is increased urinary excretion of calcium.

The metabolic profile is:

Serum calcium	Low
Serum phosphate	Low
Serum PTH	High
25 vitamin D	Normal
1,25 vitamin D	Normal
Urinary Ca	High

The treatment of renal tubular acidosis is to alkalinize the urine.

Correct Answer: Scenario 6

869. (3044) Q2-3551:

	Serum						Urine
	Ca	P	AP	PTH	25 D	1,25 D	Ca
Scenario 1	L	L	H	H	L	L	L
Scenario 2	N	L	H	N	N	N	N
Scenario 3	N	L	N	N	N	N	N
Scenario 4	L	L	H	H	N	L	L
Scenario 5	L	L	H	H	N/H	N/H	L
Scenario 6	L	L	H	H	N	N	H
Scenario 7	L	H	H	H	L	L	L

Which of the above metabolic profiles occurs in a patient with renal osteodystrophy:

1) Scenario 1
3) Scenario 5
2) Scenario 3
5) Scenario 7
4) Scenario 6

In patients with renal osteodystrophy, the renal tubular cells are damaged, resulting in the retention of phosphate. The kidney cells are unable to produce 1,25 dihydroxy vitamin D. Because the serum calcium level is low, patients develop secondary hyperparathyroidism.

The metabolic profile is:

Serum calcium	Low
Serum phosphate	High
Serum PTH	High
1,25 vitamin D	Low

The treatment is correction of the hyperparathyroidism.

Correct Answer: Scenario 7

870. (3045) Q2-3552:

Which of the following serum metabolic profiles describes a patient with hypophosphatasia:

1) Normal calcium, normal dihydroxy vitamin D, and low alkaline phosphatase
3) Low calcium, low dihydroxy vitamin D, and low alkaline phosphatase
2) Low calcium, normal dihydroxy vitamin D, and low alkaline phosphatase
5) High calcium, high dihydroxy vitamin D, and high alkaline phosphatase
4) High calcium, high dihydroxy vitamin D, and low alkaline phosphatase

Hypophosphatasia is the inability to synthesize alkaline phosphatase by the bone, leukocytes, kidney, and intestine

1. Autosomal recessive
2. High levels of phosphoethanolamine in the urine
3. When severe (high mortality)
    a. Growth retardation, failure to thrive
    b. Irritability, fever, vomiting
4. When mild
    a. Fractures
    b. Short stature
    c. Poor fracture healing
    d. Osteomalacia
5. Radiographic features
    a. Osteopenia
    b. Cup-shaped deformities of the proximal long bones
6. Histological features - unmineralized osteiod seams
7. **Laboratory features**
    a. **Low serum alkaline phosphatase**
    b. **Normal Ca, 1,25 dihydroxy vitamin D**
8. Cause - inability to mineralize osteiod because the absence of alkaline phosphatase
9. Treatment - high doses of vitamin D

Correct Answer: Normal calcium, normal dihydroxy vitamin D, and low alkaline phosphatase

---

871. (3046) Q2-3553:

Which of the following inheritance patterns occurs in patients with hypophosphatasia:

1) Autosomal recessive
3) X-linked dominant
2) Autosomal dominant
5) Sporadic
4) X-linked recessive

Hypophosphatasia is the inability to synthesize alkaline phosphatase by the bone, leukocytes, kidney, and intestine

1. **Autosomal recessive**
2. High levels of phosphoethanolamine in the urine
3. When severe (high mortality)
    a. Growth retardation, failure to thrive
    b. Irritability, fever, vomiting
4. When mild
    a. Fractures
    b. Short stature
    c. Poor fracture healing
    d. Osteomalacia
5. Radiographic features
    a. Osteopenia
    b. Cup-shaped deformities of the proximal long bones
6. Histological features - unmineralized osteiod seams
7. Laboratory features
    a. Low serum alkaline phosphatase
    b. Normal Ca, 1,25 dihydroxy vitamin D
8. Cause - inability to mineralize osteiod because the absence of alkaline phosphatase
9. Treatment - high doses of vitamin D

Correct Answer: Autosomal recessive

---

872. (3047) Q2-3554:

Which of the following is the basic defect in patients with pseudohypoparathyroidism (Albright Hereditary Osteodystrophy [AHO]):

1) End-organ resistance to 1,25 dihydroxy vitamin D
3) Inability to reabsorb phosphate in the kidney
2) End-organ resistance to parathyroid hormone (PTH)
5) Inability to synthesize alkaline phosphatase
4) Inability to produce 1,25 dihydroxy vitamin D

Pseudohypoparathyroidism (AHO) - end-organ insensitivity; in AHO, germline mutation that leads to loss of function of Galpha S (GNAS1); causes end-organ resistance to PTH

1. PHP - short stature, short metacarpals (4th and 5th), rounded facies
    a. Mental retardation, tetany
    b. Sex-linked dominant
2. Laboratory features
    a. Hypocalcemia
    b. Hyperphopshatemia
    c. Normal PTH

Correct Answer: End-organ resistance to parathyroid hormone (PTH)

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873. (3048) Q2-3555:

Which of the following is the mode of inheritance for pseudohypoparathyroidism (Albright Hereditary Osteodystrophy [AHO]):

1) Autosomal recessive
3) Sex-linked dominant
2) Autosomal dominant
5) Sporadic
4) Sex-linked recessive

Pseudohypoparathyroidism (AHO) - end-organ insensitivity; in AHO, germline mutation that leads to loss of function of Galpha S (GNAS1); causes end-organ resistance to PTH

1. PHP - short stature, short metacarpals (4th and 5th), rounded facies
    a. Mental retardation, tetany
    b. Sex-linked dominant
2. Laboratory features
    a. Hypocalcemia
    b. Hyperphopshatemia
    c. Normal PTH

Correct Answer: Sex-linked dominant

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874. (3049) Q2-3556:

Which of the following is the defect in pseudohypoparathyroidism (Albright Hereditary Osteodystrophy [AHO]):

1) Cartilage oligometric matrix protein
3) Sulfate transport protein
2) Fibroblast growth factor receptor 3
5) Galpha S (GNAS1)
4) Type II collagen

Pseudohypoparathyroidism (AHO) - end-organ insensitivity; in AHO, germline mutation that leads to loss of function of Galpha S (GNAS1); causes end-organ resistance to PTH

1. PHP - short stature, short metacarpals (4th and 5th), rounded facies
    a. Mental retardation, tetany
    b. Sex-linked dominant
2. Laboratory features
    a. Hypocalcemia
    b. Hyperphopshatemia
    c. Normal PTH

The other responses are also important to know:

- Cartilage oligometric matrix protein - pseudoachondroplasia
- Fibroblast growth factor receptor 3 - achondroplasia
- Sulfate transport protein - diastrophic dysplasia
- Type II collagen - spondyloepiphyseal dysplasia

Correct Answer: Galpha S (GNAS1)

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875. (3071) Q2-3579:

Which of the following methods reduce radiation exposure to a surgeon during fluoroscopic procedures:

1) Avoiding the inverted C-arm position
3) Limiting the use of the foot pedal for controlling the fluoroscopy unit
2) Avoiding collimation of the radiation beam
5) Increasing the amperage of each exposure
4) Always standing on the opposite side of the C-arm

One of the best ways to limit radiation exposure is to increase distance from the C-arm. Surgeons should always stand on the opposite side of the C-arm and remember the following methods for reducing radiation exposure:

- Increase distance (doubling distance reduces exposure by a factor of 4)
- Inverted position of the C-arm (increases distance)
- Shielding: 90% attenuated by 0.25-mm apron
- Collimation (reduces the size of the beam)
- Foot pedal to control the fluoroscopy unit (decreases the amount of exposure)

Correct Answer: Always standing on the opposite side of the C-arm

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876. (3072) Q2-3580:

At which of the following distances can surgeons expect to have no radiation exposure from scatter from a fluoroscopy unit:

1) 6 in
3) 2 ft
2) 1 ft
5) 6 ft
4) 3 ft

Radiation exposure decreases by a factor of 4 when a surgeon doubles the distance from the radiation beam. No radiation exists 6 ft from a fluoroscopy unit.Correct Answer: 6 ft

---

877. (3073) Q2-3581:

Which of the following amounts of radiation is received from a chest radiograph:

1) 1 mrem
3) 25 mrem
2) 10 mrem
5) 1,000 mrem
4) 500 mrem

Surgeons should know the radiation doses from common diagnostic tests.
Common radiation exposures:

- Chest radiograph 25 mrem
- Hip radiograph 500 mrem
- Hip computed tomography 1,000 mrem
- C-arm (in beam) 1,200 mrem/min to 4,000 mrem/min
- Mini C-arm (in beam) 120 mrem/min to 400 mrem/min

Correct Answer: 25 mrem

---

878. (3074) Q2-3582:

Which of the following amounts of radiation is received from a hip radiograph:

1) 10 mrem
3) 100 mrem
2) 25 mrem
5) 1,000 mrem
4) 500 mrem

Surgeons should know the radiation doses from common diagnostic tests.
Common radiation exposures:

- Chest radiograph 25 mrem
- Hip radiograph 500 mrem
- Hip computed tomography 1,000 mrem
- C-arm (in beam) 1,200 mrem/min to 4,000 mrem/min
- Mini C-arm (in beam) 120 mrem/min to 400 mrem/min

Correct Answer: 500 mrem

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879. (3075) Q2-3583:

Which of the following amounts of radiation are received from a computed tomography (CT) scan of the hip:

1) 25 mrem
3) 500 mrem
2) 100 mrem
5) 5,000 mrem
4) 1,000 mrem

Surgeons should know the radiation doses from common diagnostic tests.
Common radiation exposures:

Chest radiograph	25 mrem
Hip radiograph	500 mrem
Hip computed tomography	1,000 mrem
C-arm (in beam	1,200 mrem/min to 4,000 mrem/min
Mini C-arm (in beam	120 mrem/min to 400 mrem/min

Correct Answer: 1,000 mrem

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880. (3076) Q2-3584:

Which of the following amounts of radiation are the maximum annual exposures to the whole body, thyroid gland, and hands:

1) 1 rem, 15 rem, 25 rem
3) 5 rem, 60 rem, 100 rem
2) 2 rem, 30 rem, 50 rem
5) 20 rem, 100 rem, 200 rem
4) 10 rem, 75 rem, 150 rem

Surgeons should know the maximum annual exposures of radiation.

• Total body dose	2 rem or 5 rem
• Eye	15 rem
• Thyroid	30 rem
• Skin, hands	50 rem
• Fetus	0.5 rem over a period of 9 months (<0.05 mrem per month)

Correct Answer: 2 rem, 30 rem, 50 rem

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881. (3077) Q2-3585:

Which of the following numbers is the approximate number of intramedullary nailings of the tibia or femur that can be performed safely in regard to the maximum allowable radiation dose from a C-arm unit:

1) 50
3) 200
2) 100
5) 400
4) 300

- C- arm fluoroscopy units- 4,000 mrem/min in the beam
  - 5 mrem/min at 2 ft: scatter
  - 1 mrem/min at 4 ft: scatter
  - Distances for which no radiation is expected
    - Scatter: 0.1%, 3 ft from beam
      0.025%, 6 ft from beam
- Intramedullary nailing 100 mrem/nailing to127 mrem/nailing
  - Translates to 394 nailings per year for safe exposure
- Intramedullary nailing (femur, tibia)
  - Average exposure: 100 mrem/operation
  - Average exposure (hands): 127 mrem/operation
  - Tolerance:
    - Hands: Approximately 400 patients per year
    - Thyroid gland: 1,960 patients per year
- Important points
  - Placing pedicle screws results in the highest radiation exposure.
  - Surgeons should avoid placing their hands directly in the radiation beam.

Correct Answer: 400

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882. (3261) Q2-4088:

Which of the following statements is true concerning anterior cruciate ligament (ACL) tears in children with open physes:

1) The pattern of ACL failure is the same as adults.
3) The Lachmanâs test is seldom positive.
2) Associated meniscal tears are uncommon.
5) The pivot shift test is seldom positive.
4) The tear often occurs at the tibial insertion.

Although ACL injuries are less common in children than adults, this knee injury is becoming more common as children are involved in more athletic activities. Important points to remember include:

- In children, the ACL collagen fibers extend from the ligament to epiphyseal cartilage.
- Many ACL injuries occur at the tibial insertion.
- Tibial eminence avulsion fractures often accompany ACL injury.
- Associated meniscal injuries are common.
- The physical examination findings are the same as in adults.
- Bicycle accidents are a common mechanism of injury.

Correct Answer: The tear often occurs at the tibial insertion.

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883. (3262) Q2-4090:

Which of the following is found during differentiation of chondrocytes and the formation of the cartilage anlagen during enchondral growth:

1) CBAF1/RUNX2
3) Osterix
2) Vascular endothelial factor alpha (VEGF-A)
5) Receptor activator of nuclear factor-kB ligand (RANKL)
4) Low level of beta-catenin

Low levels of beta-catenin cause the mesenchyme to differentiate into cartilage (upregulation of SOX9). The chondrocytes develop organelles and produce cartilage specific collagens, types II, IX, and XI. The cartilage anlagen grows by interstitial and appositional growth, taking the shape of normal bones (epiphysis, metaphysis, and diaphysis).

Different processes and signals occur when the diaphysis ossifies. The cartilage cells stop growing and they hypertrophy. The chondrocytes express CBAF1/RUNX2 and VEGF-A. These factors attract blood vessels, osteoblasts, cartilage, and bone resorbing cells. The primary ossification center is then formed. The cartilage is removed, and the bone forms. At the surface of the diaphysis, the mesenchymal cells become osteoblasts and form bone.

Correct Answer: Low level of beta-catenin

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884. (3263) Q2-4091:

Which of the following is found during the process of forming the primary ossification center (transition from primary cartilage anlagen to bone):

1) SOX9
3) Low levels of beta-catenin
2) Osteoprotegerin (OPG)
5) Receptor activator of nuclear factor-kB ligand (RANKL)
4) High levels of beta-catenin

Low levels of beta-catenin cause the mesenchyme to differentiate into cartilage (up-regulation of SOX9). The chondrocytes develop organelles and produce cartilage specific collagens, types II, IX, and XI. The cartilage anlagen grows by interstitial and appositional growth, taking the shape of normal bones (epiphysis, metaphysis, and diaphysis).

Different processes and signals occur when the diaphysis ossifies. The cartilage cells stop growing and they hypertrophy. High levels of beta-catenin induce this process (involves Wnt signaling and up-regulation of beta-catenin). The chondrocytes express CBAF1/RUNX2 and VEGF-A. These factors attract blood vessels, osteoblasts, cartilage, and bone resorbing cells. The primary ossification center is then formed. The cartilage is removed, and the bone forms. At the surface of the diaphysis, the mesenchymal cells become osteoblasts and form bone.

Correct Answer: High levels of beta-catenin

---

885. (3264) Q2-4101:

Which of the following occurs with myopathies:

1) Focal demyelination
3) High amplitude-long duration motor unit potentials
2) Nerve conduction velocity slowing
5) Specific conduction block sites
4) Small amplitude-short duration motor unit potentials

With focal nerve compression, focal demyelination is present. The axon remains intact but, with myelin loss, slowing of conduction occurs and a conduction block is possible.

Common findings with focal nerve compression include:

- Focal demyelination
- Nerve conduction velocity slowing
- Conduction block across the site
- Fibrillation potentials
- Positive sharp waves
- High amplitude-long duration motor unit potentials (chronic denervation)

In contrast, small amplitude-short duration motor unit potentials are found in myopathy.

Correct Answer: Small amplitude-short duration motor unit potentials

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886. (3265) Q2-4103:

Which of the following is typically found with electrodiagnostic testing in neurogenic lesions:

1) Complex repetitive discharges
3) Myotonic discharges
2) Myokymic potentials
5) Fibrillations
4) Positive sharp waves

With electrodiagnostic testing, a clinician may find several characteristic features in different disorders:

Denervation

- Fibrillation
- Positive sharp waves
- Fasciculations

Neurogenic lesions

- Fasciculations
- Myokymic potentials

Myopathies

- Complex repetitive discharges
- Myotonic discharges

Correct Answer: Myokymic potentials

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887. (3266) Q2-4104:

Which of the following is typically found with electrodiagnostic testing in myopathies:

1) Positive sharp waves and fibrillations
3) Complex repetitive discharges and myotonic discharges
2) Positive sharp waves
5) Myokymic potentials
4) Fasciculations and myokymic potentials

With electrodiagnostic testing, a clinician may find several characteristic features in different disorders:

Denervation

- Fibrillation
- Positive sharp waves
- Fasciculations

Neurogenic lesions

- Fasciculations
- Myokymic potentials

Myopathies

- Complex repetitive discharges
- Myotonic discharges

Correct Answer: Complex repetitive discharges and myotonic discharges

---

888. (3267) Q2-4106:

Fasciculation potentials are spontaneous discharges of whole motor units. This type of electrodiagnositic finding is found in each of the following disorders except:

1) Anterior motor horn disease
3) Cervical spondylytic myelopathy
2) Radiculopathy
5) Demyelinating myopathy
4) Muscle denervation

Fasciculation potentials are spontaneous discharges of the whole motor unit. This electrodiagnostic finding is found in:

- Anterior motor horn diseases
- Cervical spondylytic myelopathy
- Radiculopathy
- Demyelinating neuropathy

With denervation of skeletal muscle, electrodiagnostic testing includes:

- Fibrillation potentials
    - Low amplitude short bi- or triphasic deflections
- Positive sharp waves
    - Positive deflections followed by a negative wave

Correct Answer: Muscle denervation

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889. (3268) Q2-4111:

Which of the following statements is true concerning intraoperative acetabular fractures following uncemented total hip arthroplasty:

1) The incidence is lowest with an elliptical monoblock design.
3) The location of the fracture is most commonly anterosuperior.
2) The incidence is highest with a hemispherical modular cup design.
5) The location of the fracture is most commonly direct medial.
4) The location of the fracture is most commonly posterior superior.

Intraoperative acetabular fractures with uncemented cups are rare. This Mayo Clinic study showed a fracture rate of 3.5% with an elliptical monoblock cup. The rate with the monoblock cup was significantly higher than the elliptical modular and hemispherical modular designs (both <0.5%). The fractures were usually found posterior superior (12/21), direct posterior (posterior wall) (6/21), and much less commonly anterosuperior or medial. If the cup was unstable after the fracture, then it was removed, and another cup with screw fixation was used. All fractures healed uneventfully with no adverse sequelae. The authors recommend under-reaming ≤2 mm regardless of cup design.Correct Answer: The location of the fracture is most commonly posterior superior.

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890. (3269) Q2-4112:

Which of the following statements is true concerning patients who have an immediate motor nerve palsy following a total hip arthroplasty:

1) Sciatic nerve palsy is more common than peroneal nerve palsy.
3) The majority of patients with an incomplete palsy will have a full recovery.
2) The majority of patients with a complete motor palsy will have a full recovery.
5) Previous hip surgery is not a signicant risk factor.
4) A body mass index of 30 or higher is a significant risk factor.

Farrell and colleagues from the Mayo Clinic recently reported a 0.17% rate of motor nerve palsy following 27,000 primary hip arthroplasties.

The important points to remember are:

- Nerve distribution: peroneal 64%; sciatic 30%; femoral 6%
- Complete nerve palsy 62%; incomplete 38%
- 87% of patients had a sensory deficit
- Presumptive etiology in 26/47 (hematoma, traction, limb lengthening, laceration)
- Recovery
    - Complete palsy: full 36%; partial 39%; none 25%
    - Incomplete palsy: full 39%; partial 17%; none 44%
- Leg lengthening is a significant risk factor (conditional logistic regression)
    - Odds ratio 1:1
    - Average lengthening 1.7 cm (range: 1.1 cm to 4.4 cm)
- Significant factors (univariate logistic regression)
    - Developmental dysplasia
    - Post-traumatic arthritis
    - Posterior approach
    - Uncemented arthroplasty
- 46% required a walking aid at follow-up

Correct Answer: Previous hip surgery is not a signicant risk factor.

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891. (3270) Q2-4113:

Which of the following is a significant risk factor for a motor nerve palsy following a primary hip replacement:

1) Age <50 years
3) Prior hip surgery
2) Female sex
5) Developmental dysplasia
4) Body mass index >30

Farrell and colleagues from the Mayo Clinic recently reported a 0.17% rate of motor nerve palsy following 27,000 primary hip arthroplasties.

The important points to remember are:

- Nerve distribution: peroneal 64%; sciatic 30%; femoral 6%
- Complete nerve palsy 62%; incomplete 38%
- 87% of patients had a sensory deficit
- Presumptive etiology in 26/47 (hematoma, traction, limb lengthening, laceration)
- Recovery
  - Complete palsy: full 36%; partial 39%; none 25%
  - Incomplete palsy: full 39%; partial 17%; none 44%
- Leg lengthening is a significant risk factor (conditional logistic regression)
  - Odds ratio 1:1
  - Average lengthening 1.7 cm (range: 1.1 cm to 4.4 cm)
- Significant factors (univariate logistic regression)
  - Developmental dysplasia
  - Post-traumatic arthritis
  - Posterior approach
  - Uncemented arthroplasty
- 46% required a walking aid at follow-up

Correct Answer: Developmental dysplasia

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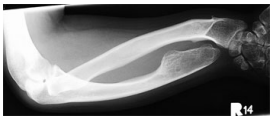
892. (3280) Q2-4124:



slide 1 **slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. The most likely diagnosis is:

1) Enchondromatosis
3) Multiple hereditary exostoses
2) Eosinophilic granuloma
5) Spondyloepiphyseal dysplasia
4) Fibrous dysplasia

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: Multiple hereditary exostoses

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893. (3281) Q2-4125:

Which of the following statements is true in patients who have an immediate motor nerve palsy following a total hip arthroplasty:

1) Sciatic nerve palsy is more common than peroneal nerve palsy.
3) The majority of patients with an incomplete palsy will have a full recovery.
2) The majority of patients with a complete motor palsy will have a full recovery.
5) Prior hip surgery is not a significant risk factor
4) A body mass index of 30 or higher is a significant risk factor.

Farrell and colleagues from the Mayo Clinic recently reported a 0.17% rate of motor nerve palsy following 27,000 primary hip arthroplasties.

The important points to remember are:

- Nerve distribution: peroneal, 64%; sciatic, 30%; femoral, 6%
- Complete nerve palsy, 62%; incomplete, 38%
- 87% had a sensory deficit
- Presumptive etiology in 26/47: hematoma, traction, limb lengthening, laceration
- Recovery
    - Complete palsy: full, 36%; partial, 39%; none, 25%
    - Incomplete palsy: full, 39%; partial, 17%; none, 44%
- Leg lengthening is a significant risk factor (conditional logistic regression)
    - Odds ratio -1.1
    - Average lengthening 1.7 cm, range -1.1 to 4.4 cm
- Significant factors (univariate logistic regression)
    - Developmental dysplasia
    - Posttraumatic arthritis
    - Posterior approach
    - Uncemented arthroplasty
- 46% required a walking aid at follow-up

Correct Answer: Prior hip surgery is not a significant risk factor

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894. (3282) Q2-4126:

Which of the following is a significant risk factor for a motor nerve palsy following a primary hip replacement:

1) Age <50 years
3) Previous hip surgery
2) Female sex
5) Developmental dysplasia
4) Body mass index greater than 30

Farrell and colleagues from the Mayo Clinic recently reported a 0.17% rate of motor nerve palsy following 27,000 primary hip arthroplasties.

The important points to remember are:

- Nerve distribution: peroneal, 64%; sciatic, 30%; femoral, 6%
- Complete nerve palsy, 62%; incomplete, 38%
- 87% had a sensory deficit
- Presumptive etiology in 26/47: hematoma, traction, limb lengthening, laceration
- Recovery
    - Complete palsy: full, 36%; partial, 39%; none, 25%
    - Incomplete palsy: full, 39%; partial, 17%; none, 44%
- Leg lengthening is a significant risk factor (conditional logistic regression)
    - Odds ratio -1.1
    - Average lengthening 1.7 cm, range -1.1 to 4.4 cm
- Significant factors (univariate logistic regression)
    - Developmental dysplasia
    - Posttraumatic arthritis
    - Posterior approach
    - Uncemented arthroplasty
- 46% required a walking aid at follow-up

Correct Answer: Developmental dysplasia

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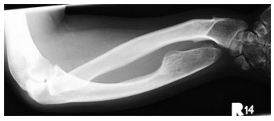
895. (3283) Q2-4127:



Slide 1 **Slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. What is the most likely inheritance pattern of this condition:

1) X-linked recessive
3) Autosomal recessive
2) X-linked dominant
5) Sporadic
4) Autosomal dominant

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: Autosomal dominant

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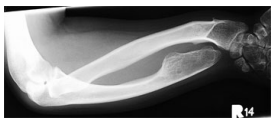
896. (3284) Q2-4128:



Slide 1 **Slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. Which of the following tumor suppressor genes is most likely involved:

1) Retinoblastoma (RB)
3) P16INK4A
2) p53
5) EXT1
4) NF1

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: EXT1

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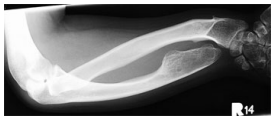
897. (3285) Q2-4129:



Slide 1 **Slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. The risk of malignancy in this condition is approximately:

1) No risk of malignancy
3) 25%
2) 5% to 10%
5) 100%
4) 50%

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: 5% to 10%

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898. (3286) Q2-4130:

Which of the following statements is true concerning the nonoperative treatment of moderately displaced fractures (2 mm to 5 mm) that involve >30% of the articular surface (Mason type IIa):

1) Elbow extension loss averages approximately 20Â° to 30Â°.
3) More than 80% of patients have no subjective complaints at long-term follow-up.
2) Grip strength is significantly reduced.
5) Proximal radioulnar synostosis occurs in 20% of patients.
4) Patients requiring late radial head excision have significant functional limitations.

This long-term follow-up study of 49 patients with Mason type IIa radial head fractures (2 mm to 5 mm displacement, >30% of the articular surface) showed that 82% of patients had no elbow complaints. Only one patient had poor function. The loss of elbow extension was only 3Â° and the loss of elbow flexion only 2Â°. The elbow valgus angle averaged 10Â° in the injured elbow compared to 8Â° in the noninjured elbow. There was no difference in forearm pronation and only a 2Â° loss of forearm supination. No difference in elbow strength, grip strength, or forearm circumference was reported. Six of 49 patients (11%) required late radial head excision; two of these patients had no symptoms and four had mild symptoms. The authors recommend nonoperative treatment of Mason type IIa radial head fractures.Correct Answer: More than 80% of patients have no subjective complaints at long-term follow-up.

---

899. (3287) Q2-4131:

Which of the following statements is false following nonoperative treatment of Mason type IIa fractures (2 mm to 5 mm displacement, >30% of the articular surface):

1) Proximal radioulnar synostosis is rare.
3) Forearm pronation loss averages 25Â°.
2) Patients requiring radial head excision have minor functional problems.
5) Elbow strength and forearm circumference are normal.
4) Grip strength is reduced.

This long-term follow-up study of 49 patients with Mason type IIa radial head fractures (2 mm to 5 mm displacement, .30% of the articular surface) showed that 82% of patients had no elbow complaints. Only one patient had poor function. The loss of elbow extension was only 3Â° and the loss of elbow flexion only 2Â°. The elbow valgus angle averaged 10Â° in the injured elbow compared to 8Â° in the noninjured elbow. There was no difference in forearm pronation and only a 2Â° loss of forearm supination. No difference in elbow strength, grip strength, or forearm circumference was reported. Six of 49 patients (11%) required late radial head excision; two of these patients had no symptoms and four had mild symptoms. The authors recommend nonoperative treatment of Mason type IIa radial head fractures.Correct Answer: Forearm pronation loss averages 25Â°.

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900. (3288) Q2-4132:

Using the technique of homologous recombination in a knockout mouse model in which the receptor activator of nuclear factor-kB ligand (RANKL) or RANK gene is deleted, which of the following conditions will most likely develop:

1) Multiple hereditary exostosis
3) Primary osteoporosis
2) Primary hyperparathyroidism
5) Osteopetrosis
4) Secondary osteoporosis

The RANKL is the final common denominator of osteoclast activation. Numerous conditions such as bone metastases, multiple myeloma, osteoporosis, hyperparathyroidism, and others result in osteoclast activation. In these conditions, there is an increased expression and release of the RANKL from the surface of the osteoblasts and marrow stromal cells. The RANKL then binds to the RANK receptor on the osteoclast precursor cells, differentiating into active osteoclasts.

If one knocks out the RANKL or RANK receptor, then osteoclast precursor cells cannot be activated. As a result, no bone resorption or osteopetrosis occurs.

In osteopetrosis, a lack of osteoclasts results in dense bone with virtually no marrow cavity.

Correct Answer: Osteopetrosis

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901. (3289) Q2-4133:

The receptor activator of nuclear factor-kB ligand (RANKL) is expressed on the surface of which of the following cells:

1) Osteoclasts
3) Platelets
2) Osteoblasts and marrow stromal cells
5) Vascular endothelial cells
4) Macrophages

The RANKL is the final common denominator of osteoclast activation and is expressed on the surface of osteoblasts and marrow stromal cells.

Numerous conditions such as bone metastases, multiple myeloma, osteoporosis, hyperparathyroidism, and others result in osteoclast activation. In these conditions, there is an increased expression and release of the RANKL from the surface of the osteoblasts and marrow stromal cells. The RANKL then binds to the RANK receptor on the osteoclast precursor cells, differentiating into active osteoclasts.

Correct Answer: Osteoblasts and marrow stromal cells

---

902. (3290) Q2-4134:

In transgenic mice, the overproduction of osteoprotegerin (OPG) results in which of the following conditions:

1) Multiple hereditary exostoses
3) Secondary hyperparathyroidism
2) Primary hyperparathyroidism
5) Osteopetrosis
4) Primary osteoporosis

Osteoprotegerin is a competitive decoy inhibitor that binds the receptor activator of nuclear factor-kB ligand (RANKL), thereby preventing the RANKL from attaching to the RANK receptor on osteoclast precursor cells. The ratio of the RANKL to OPG determines whether osteclast activation occurs.

When overproduction of OPG occurs, there is a marked reduction in osteoclast activation. In this scenario, osteopetrosis develops. In osteopetrosis, a lack of osteoclasts results in dense bone with virtually no marrow cavity.

Correct Answer: Osteopetrosis

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903. (3291) Q2-4135:

Which of the following factors are essential for osteoblast differentiation:

1) Dihydrofolate reductase
3) Insulin-like growth factor 1
2) Core binding factor alpha 1 (CBFA1 or Runx2)
5) Osteoprotegerin (OPG)
4) Receptor activator of nuclear factor-kB ligand (RANKL)

Osteoblasts arise from mesenchymal stem cells. Core binding factor alpha (CBFA1 or Runx2) is a transcription factor that induces most genes that are associated with osteoblast differentiation.Correct Answer: Core binding factor alpha 1 (CBFA1 or Runx2)

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904. (3292) Q2-4136:

Which of the following factors most likely has a role in the production of osteoblastic bone metastases:

1) Receptor activator of nuclear factor-kB ligand (RANKL)
3) Osteoprotegerin (OPG)
2) Parathyroid hormone-related protein (PTHrP)
5) Macrophage inflammatory protein (MIP) 1 alpha
4) Endothelin-1

Endothelin-1 likely plays a major role in blastic metastases in breast and prostate cancers. Endothelin-1 stimulates bone formation and the proliferation of osteoblasts.

The mechanism of bone formation is not nearly as well defined as bone destruction in metastatic bone disease.

Correct Answer: Endothelin-1

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905. (4059) Q2-4137:

Which of the following is a marker for osteoclastic activity:

1) Serum bone specific alkaline phosphatase
3) Serum type 1 procollagen C-propeptide
2) Serum osteocalcin
5) Serum endothelin-1
4) Urine type 1 collagen cross-linked N-telopeptides

The markers of osteoclastic activity are:

- Serum C-terminal telopeptide of type 1 collagen
- Serum tartrate resistant acid phosphatase
- Urine type 1 collagen cross-linked N-telopeptides
- Urine C-terminal telopeptide of type 1 collagen

The markers of osteoblastic activity are:

- Serum bone specific alkaline phosphatase
- Serum osteocalcin
- Serum type 1 procollagen C-propeptide
- Serum endothelin-1

Correct Answer: Urine type 1 collagen cross-linked N-telopeptides

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906. (4060) Q2-4138:

Which of the following is a marker for osteoblastic activity:

1) Serum C-terminal telopeptide of type-1 collagen
3) Urine type-1 collagen cross linked N-telopeptides
2) Serum tartrate resistant acid phosphatase
5) Serum osteocalcin
4) Urine C-terminal telopeptide of type 1 collagen

The markers of osteoclastic activity are:

- Serum C-terminal telopeptide of type 1 collagen
- Serum tartrate resistant acid phosphatase
- Urine type 1 collagen cross-linked N-telopeptides
- Urine C-terminal telopeptide of type 1 collagen

The markers of osteoblastic activity are:

- Serum bone specific alkaline phosphatase
- Serum osteocalcin
- Serum type 1 procollagen C-propeptide
- Serum endothelin-1

Correct Answer: Serum osteocalcin

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907. (3293) Q2-4139:

Which of the following is a marker for osteoblastic activity:

1) Serum C-terminal telopeptide of type 1 collagen
3) Urine type 1 collagen cross-linked N-telopeptides
2) Serum tartrate resistant acid phosphatase
5) Serum endothelin-1
4) Urine C-terminal telopeptide of type 1 collagen

The markers of osteoclastic activity are:

- Serum C-terminal telopeptide of type 1 collagen
- Serum tartrate resistant acid phosphatase
- Urine type 1 collagen cross-linked N-telopeptides
- Urine C-terminal telopeptide of type 1 collagen

The markers of osteoblastic activity are:

- Serum bone specific alkaline phosphatase
- Serum osteocalcin
- Serum type 1 procollagen C-propeptide
- Serum endothelin-1

Correct Answer: Serum endothelin-1

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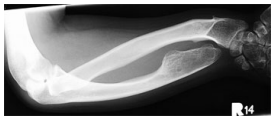
908. (3294) Q2-4140:



A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. The most likely diagnosis is:

1) Enchondromatosis
3) Multiple hereditary exostoses
2) Eosinophilic granuloma
5) Spondyloepiphyseal dysplasia
4) Fibrous dysplasia

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: Multiple hereditary exostoses

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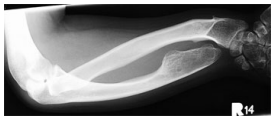
909. (3295) Q2-4141:



slide 1 **slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. What is the most likely inheritance pattern of this condition:

1) X-linked recessive
3) Autosomal recessive
2) X-linked dominant
5) Sporadic
4) Autosomal dominant

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: Autosomal dominant

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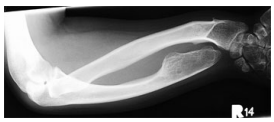
910. (3296) Q2-4142:



slide 1 **slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. Which of the following tumor suppressor genes is most likely involved:

1) Retinoblastoma (RB)
3) P16INK4A
2) p53
5) EXT1
4) NF1

This patient has multiple hereditary exostoses. Note the multiple sessile osteochondromas on the humerus and ulna. A characteristic bowing deformity of the forearm and pseudo-Madelung deformity of the wrist are also present.

Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: EXT1

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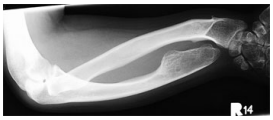
911. (3297) Q2-4143:



slide 1 **slide 2**

A patientâs upper extremity radiographs are shown in Slide 1 and Slide 2. The risk of malignancy in this condition is approximately:

1) No risk of malignancy
3) 25%
2) 5% to 10%
5) 100%
4) 50%

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Multiple hereditary exostoses is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring is approximately 10%.

In most patients, the forearm deformity does not cause a major problem and can be treated nonoperatively.

Correct Answer: 5% to 10%

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912. (3298) Q2-4144:

Which of the following is an indication for surgery in patients with rheumatoid arthritis of the spine:

1) Posterior atlantodental interval between 14 mm and 16 mm
3) Cervico-medullary angle between 135Â° and 175Â°
2) Atlantodental interval >5 mm
5) Posterior atlantodental interval of 13 mm with subaxial subluxation
4) Odontoid migration of 4 mm above McGregorâs line

The review article by Kim and Hilibrand summarized the current indications for decompression and fusion in patients with rheumatoid arthritis and cervical spine disease.

The indications are:

A. Progressive neurologic deficit
    1. Myelopathy â wide-based spastic gait, clumsy hands, change in handwriting, difficulty with fine motor control
B. Severe neck pain with atlantoaxial subluxation, atlantoaxial impaction, or subaxial subluxation
C. Atlantoaxial subluxation with a posterior atlantodental interval of <14 mm
D. Atlantoaxial impaction â odontoid migration >5 mm above McGregorâs line
E. Subaxial subluxation with a sagittal canal diameter <14 mm
F. Cervicomedullary angle <135Â°

Correct Answer: Posterior atlantodental interval of 13 mm with subaxial subluxation

---

913. (3299) Q2-4145:

Which of the following statements is true concerning rheumatoid arthritis:

1) Rheumatoid arthritis does not affect life expectancy.
3) Erosion of the odontoid rarely occurs.
2) Men are affected twice as much as women.
5) Rheumatoid arthritis affects approximately 1% of the U.S. population
4) The atlantodental interval is the best prognostic factor for neurologic injury.

Rheumatoid arthritis is common and affects 0.5% to 1.5% of the U.S. population.

Important points to remember include:

- Women are affected twice as commonly as men.
- Rheumatoid arthritis reduces life expectancy.
- Blockade of tumor necrosis alpha can be very effective.
- The posterior atlantodental interval is more important than the anterior atlantodental interval.
- A prospective study from Finland showed that over a 20-year period, patients with seropositive rheumatoid arthritis had the following risk of cervical spine disease:
    - Atlantoaxial subluxation â 23%
    - Atlantoaxial impaction â 26%
    - Subaxial subluxation â 19%

Correct Answer: Rheumatoid arthritis affects approximately 1% of the U.S. population

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914. (3300) Q2-4146:

Which of the following is a risk factor for progressive atlantoaxial subluxation in patients with rheumatoid arthritis of the cervical spine:

1) Male sex
3) HLA-b27 antigen
2) HLA-dr4 antigen
5) Seronegativity
4) Steroid use

In a review article, Kim and Hilibrand list the following as risk factors for progression of atlantoaxial subluxation in rheumatoid arthritis:

- Male sex
- Rheumatoid factor positivity
- Presence of subcutaneous nodules
- Rapid loss of carpal height

In contrast to the above, HLA-dr4 and HLA-b27 antigens are not significant risk factors. The use of steroids does not appear to be a significant risk factor.

Correct Answer: Male sex

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915. (3301) Q2-4147:

Which of the following posterior atlantodental intervals is associated with a very poor neurologic recovery following decompression and fusion:

1) <10 mm
3) 11 mm to 13 mm
2) 10 mm to 12 mm
5) 16 mm
4) 14 mm

In a review article, Kim and Hilibrand cite the reports of Boden which showed that, when the posterior atlantodental interval was <10 mm, patients did not experience any neurologic recovery following surgery.

In regard to preoperative posterior atlantodental interval, one should remember:

- <10 mm No recovery
- >10 mm Recovery of at least one Ranawat grade
- >14 mm Complete recovery

Correct Answer: <10 mm

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916. (3434) Q2-4355:

Osteochondroses of the tarsal navicular or the capitellum in a child is most likely the result of:

1) Genetic disorder
3) Benign neoplasm
2) Developmental disorder
5) Vascular insufficiency
4) Repetitive stress

The osteochondroses represent disordered growth and function of enchondral ossification under load or stress in a growing child. The causative stress is usually from overuse (eg, pitching). The disordered ossification is often accompanied by deformation of the cartilage and its adjacent interface with bone. In areas where the cartilage is under tension, the term apophysitis is also used.Correct Answer: Repetitive stress

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917. (3445) Q2-4372:

All of the following occur with focal nerve compression except:

1) Focal demyelination
3) Conduction block across the site
2) Nerve conduction velocity slowing
5) Small amplitude-short duration motor unit potentials
4) Fibrillation potentials and positive sharp waves

With focal nerve compression, focal demyelination is present. The axon remains intact but, with myelin loss, slowing of conduction occurs and a conduction block is possible.

Common findings with focal nerve compression include:

- Focal demyelination
- Nerve conduction velocity slowing
- Conduction block across the site
- Fibrillation potentials
- Positive sharp waves
- High amplitude-long duration motor unit potentials (chronic denervation)

In contrast, small amplitude-short duration motor unit potentials are found in myopathy.

Correct Answer: Small amplitude-short duration motor unit potentials

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918. (3446) Q2-4373:

Which of the following is typically found on electrodiagnostic testing with denervation of skeletal muscle:

1) Complex repetitive discharges
3) Myokymic potentials
2) Myotonic discharges
5) Myotonic discharges and myokymic potentials
4) Positive sharp waves and fibrillations

With electrodiagnostic testing, a clinician may find several characteristic features in different disorders:

Denervation

- Fibrillation
- Positive sharp waves
  Fasciculations

Neurogenic lesions

- Fasciculations
- Myokymic potentials

Myopathies

- Complex repetitive discharges
- Myotonic discharges

Correct Answer: Positive sharp waves and fibrillations

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919. (3447) Q2-4374:

Which of the following factors is crucial for the differentiation of mesenchymal cells to osteoblasts:

1) Type X collagen
3) CBAF1/RUNX2
2) Type II collagen
5) Receptor activator of nuclear factor-kB ligand (RANKL)
4) Low level of beta-catenin

CBAF1/RUNX2 is a transcription factor that is essential for differentiation of mesenchymal cells to osteoblasts. This transcription factor is expressed during intramembranous bone formation and during hypertrophic phase of enchondral growth.

Cleidiocranial dysplasia is caused by a failure to mineralize the cartilage anlagen. This genetic disorder is caused by a loss of function in CBAF1/RUNX2.

Phenotype of cleidocranial dysplasia includes:

- Short stature
- Hypoplasia/aplasia of the clavicles
- Delayed ossification and closure of cranial sutures
- Defects in tooth eruption and extra teeth

Correct Answer: CBAF1/RUNX2

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920. (3448) Q2-4375:

Which of the following disorders occurs with a loss of function mutation (heterozygous) in CBAF1/RUNX2:

1) Achondroplasia
3) Cleidocranial dysplasia
2) Osteopetrosis
5) Tertiary hyperparathyroidism
4) Primary osteoporosis

Cleidocranial dysplasia is caused by a failure to mineralize the cartilage anlagen. This genetic disorder is caused by a loss of function in CBAF1/RUNX2.

Phenotype of cleidocranial dysplasia includes:

- Short stature
- Hypoplasia/aplasia of the clavicles
- Delayed ossification and closure of cranial sutures
- Defects in tooth eruption and extra teeth

Correct Answer: Cleidocranial dysplasia

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921. (3449) Q2-4376:

A patient sustains a humeral fracture that results in radial nerve palsy. At which of the following time points would an electrodiagnostic study be performed to check the integrity of the radial nerve:

1) Immediately following the injury
3) 14 days following the injury
2) 7 days following the injury
5) 6 to 8 weeks following the injury
4) 21 days following the injury

At 6 to 8 weeks following the injury, a clinician should perform an electrodiagnostic study to detect reinnervation. A needle electromyogram will show small amplitude polyphasic motor unit potentials.

The following is the typical of sequence of electrodiagnostic findings:

- Severance of the nerve
  - Positive sharp waves and fibrillation potentials at 2 weeks
- Incomplete nerve injury
  - Small amplitude motor unit potentials at 6 to 8 weeks

Correct Answer: 6 to 8 weeks following the injury

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922. (3453) Q2-4381:

Which of the following factors plays a major role in inducing cells to form osteoblasts with resultant intramembranous bone formation:

1) Stable beta-catenin
3) Receptor activator of nuclear factor-kB ligand (RANKL)
2) SOX9
5) Type II collagen
4) Osteoprotegerin (OPG)

Bone forms from either intramembranous bone formation or enchondral bone formation.

Intramembranous bone formation occurs in the skull, maxilla, mandible, clavicle, and subperiosteal surface of long bones. This is a complex process and is controlled by a signaling pathway called canonical Wnt and sonic hedgehog signaling. Beta-catenin is not degraded, and it enters the cell nucleus to induce genes for bone formation. The two most important transcription factors are CBFA1/RUNX2 and osterix (OSX). Stable beta-catenin drives the process toward intramembranous bone formation.

Angiogenesis is also important and vascular endothelial factor alpha (VEGF-A) plays an important role in bone formation.

Correct Answer: Stable beta-catenin

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923. (3454) Q2-4382:

Which of the following statements is true concerning intraoperative acetabular fractures following uncemented total hip arthroplasty:

1) The incidence is highest with an elliptical modular cup design.
3) The incidence is highest with an elliptical monoblock design.
2) The incidence is highest with a true elliptical modular cup design.
5) Plate fixation in addition to augmentation of the cup with screws is often necessary.
4) The location of the fracture is most likely to be anterosuperior.

Intraoperative acetabular fractures with uncemented cups are rare. This Mayo Clinic study showed a fracture rate of 3.5% with an elliptical monoblock cup. The rate with the monoblock cup was significantly higher than the elliptical modular and hemispherical modular designs (both <0.5%). The fractures were usually found posterior superior (12/21), direct posterior (posterior wall) (6/21), and much less commonly anterosuperior or medial. If the cup was unstable after the fracture, then it was removed, and another cup with screw fixation was used. All fractures healed uneventfully with no adverse sequelae. The authors recommend under-reaming ≤2 mm regardless of cup design.Correct Answer: The incidence is highest with an elliptical monoblock design.

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924. (3456) Q2-4384:

Which of the following is associated with achondroplasia:

1) Heterozygous loss of function mutation, CBF1/RUNX2
3) Parathyroid hormone-related protein (PTHrP) â loss of function mutation
2) Collagen type X mutation
5) PTHrP activating mutation
4) Activating mutation of fibroblast growth factor receptor-3 (FGFR-3)

In achondroplasia, an activating mutation of the FGFR-3 is present.

During enchondral growth, the proliferation of the chondrocytes is controlled by fibroblast growth factor (FGF). FGF interacts with a cell surface tyrosine kinase receptor, FGFR-3. An activating mutation causes increased signaling for limitation of cartilage proliferation in the growth plate, resulting in short limbs.

The important mutations that cause short stature include:

- Achondroplasia: Activating mutation of FGFR-3
- Jansenâs metaphyseal chondrodysplasia: Activating mutation of PTHrP
- Blomstrandâs chondrodysplasia: Loss of function mutation of PTHrP
- Cleidocranial dysplasia: Heterozygous loss of function mutation, CBF1/RUNX2
- Schmidâs type metaphyseal chondrodysplasia: Type X collagen mutation

Correct Answer: Activating mutation of fibroblast growth factor receptor-3 (FGFR-3)

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925. (3458) Q2-4389:

Which of the following is the best diagnostic test to establish the diagnosis of cubital tunnel syndrome:

1) Sensory nerve conduction velocity, finger to wrist
3) Mixed nerve conduction velocity, finger to wrist
2) Motor nerve conduction velocity across the elbow
5) Motor conduction, elbow to axilla
4) Motor conduction, Erbâs point to axilla

Motor nerve conduction velocity testing across the elbow is the best diagnostic test to establish the diagnosis of cubital tunnel syndrome.Correct Answer: Motor nerve conduction velocity across the elbow

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926. (3459) Q2-4391:

Which of the following are typically found following a complete laceration of a peripheral nerve after 3 weeks:

1) Fasciculation potentials
3) Myokymic potentials
2) Fibrillation potentials and positive sharp waves
5) Complex repetitive discharges
4) Myotonic discharges

A complete laceration of a peripheral nerve is a denervation injury.

With electrodiagnostic testing, a clinician may find several characteristic features in different disorders:

Denervation

- Fibrillation
- Positive sharp waves
- Fasciculations

Neurogenic lesions

- Fasciculations
- Myokymic potentials

Myopathies

- Complex repetitive discharges
- Myotonic discharges

Correct Answer: Fibrillation potentials and positive sharp waves

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927. (3461) Q2-4393:

When the cartilage anlagen is expressed during the process of enchondral ossification, which of the following types of collagen is produced:

1) Types I, III
3) Type X
2) Types II, IX, XI
5) Types I, III, X
4) Type I

During the time that the cartilage anlagen is formed, the chondrocytes (or mesenchymal cells) produce cartilage-specific collagen. The collagen expression is shifted from the bone collagens (types I, III) to the cartilage collagens (types II, IX, XI).

Important points:

- Type I: Major bone collagen
- Types II, IX, and XI: Major cartilage collagens
- Type X: Major collagen of hypertrophying and mineralizing chondrocytes

Correct Answer: Types II, IX, XI

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928. (3462) Q2-4396:

Which of the following is associated with Jansenâs metaphyseal chondrodysplasia:

1) Heterozygous loss of function mutation, CBF1/RUNX2
3) Parathyroid hormone-related protein (PTHrP) â loss of function mutation
2) Collagen type X mutation
5) PTHrP activating mutation
4) Activating mutation of fibroblast growth factor receptor-3 (FGFR-3)

Parathyroid hormone-related protein (PTHrP) has a specific inhibitory effect on chondrocyte differentiation (inability to hypertrophy). During enchondral growth, the chondrocytes hypertrophy and then mineralize to form bone.

Activating mutations of PTHrP cause a decrease in chondrocyte hypertrophy and result in short stature (Jansenâs metaphyseal chondrodysplasia). Blomstrandâs chondrodysplasia involves a loss of function mutation, resulting in accelerated chondrocyte hypertrophy and short stature.

Parathyroid hormone-related protein also affects Indian hedgehog signaling while Indian hedgehog induces PTHrP (self-regulating feedback loop). Indian hedgehog is a positive regulator of chondrocyte proliferation and osteoblastic differentiation in the perichondral ring.

Correct Answer: PTHrP activating mutation

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929. (3466) Q2-4403:

Which of the following statements is true concerning anterior cruciate ligament (ACL) tears in children with open physes:

1) The pattern of ACL failure is the same as adults.
3) The Lachmanâs test is seldom positive.
2) Associated meniscal tears are uncommon.
5) The pivot shift test is seldom positive.
4) The tear often occurs at the tibial insertion.

Although ACL injuries are less common in children than adults, this type of knee injury is becoming more common as children are involved in more athletic activities. Important points to remember include:

- In children, the ACL collagen fibers extend from the ligament to epiphyseal cartilage.
- Many ACL injuries occur at the tibial insertion.
- Tibial eminence avulsion fractures often accompany ACL injury.
- Associated meniscal injuries are common.
- The physical examination findings are the same as in adults.
- Bicycle accidents are a common mechanism of injury.

Correct Answer: The tear often occurs at the tibial insertion.

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930. (3468) Q2-4405:

Which of the following is associated with Schmidâs type metaphyseal chondrodysplasia:

1) Type X collagen mutation
3) Activating mutation of fibroblast growth factor receptor-3 (FGFR-3)
2) Heterozygous loss of function mutation, CBF1/RUNX2
5) PTHrP loss of function mutation
4) Parathyroid hormone-related protein (PTHrP) activating mutation

Type X collagen mutations result in Schmidâs type metaphyseal chondrodysplasia.

Collagen type X is uniquely expressed by hypertrophic chondrocytes. The extracellular matrix that is formed by the hypertrophic chondrocytes is easily degraded. There are high levels of expression of vascular endothelial growth factor A and marked ingrowth of blood vessels, osteoclasts, and osteoblasts. Hypertrophic chondrocytes are resorbed, and the matrix mineralizes. When defects in type X collagen exist, an interruption of normal longitudinal growth occurs.

Correct Answer: Type X collagen mutation

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931. (3477) Q2-4416:

Which of the following is the most sensitive electrodiagnostic study to establish the diagnosis of carpal tunnel syndrome:

1) Nerve conduction across the finger to wrist segment
3) Motor conduction â wrist to elbow
2) Terminal latency
5) Sensory nerve conduction across the palm wrist segment
4) Mixed conduction â wrist to elbow

Sensory nerve conduction across the palm to wrist segment is the most sensitive electrodiagnostic finding in carpal tunnel syndrome.

The accuracy of electrodiagnostic testing is good:

- Sensitivity â 85% to 90%
- Specificity â 95%

Correct Answer: Sensory nerve conduction across the palm wrist segment

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932. (3497) Q2-4441:

Which of the following is uniquely expressed by hypertrophying chondrocytes during longitudinal growth:

1) Stable beta-catenin
3) CBAF1/RUNX2
2) Type X collagen
5) Type II collagen
4) Parathyroid hormone-related protein (PTHrP)

Collagen type X is uniquely expressed by hypertrophic chondrocytes. The extracellular matrix that is formed by the hypertrophic chondrocytes is easily degraded. There are high levels of expression of VEGFA and marked ingrowth of blood vessels, osteoclasts, and osteoblasts. The hypertrophic chondrocytes are resorbed, and the matrix mineralizes. When defects in type X collagen are present, then an interruption of normal longitudinal growth occurs.

Type X collagen mutations result in Schmidâs type metaphyseal chondrodysplasia.

Correct Answer: Type X collagen

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933. (3499) Q2-4445:

Which of the following factors is critical for normal enchondral growth in regard to hypertrophying chondrocytes:

1) Stable beta-catenin
3) CBAF1/RUNX2
2) Parathyroid hormone-related protein (PTHrP)
5) Osterix
4) Type X collagen/vascular endothelial growth factor A (VEGFA)

Collagen type X is uniquely expressed by hypertrophic chondrocytes. The extracellular matrix that is formed by the hypertrophic chondrocytes is easily degraded. There are high levels of expression of VEGFA and marked ingrowth of blood vessels, osteoclasts, and osteoblasts. The hypertrophic chondrocytes are resorbed, and the matrix mineralizes. When defects in type X collagen are present, then an interruption of normal longitudinal growth occurs.

Type X collagen mutations result in Schmidâs type metaphyseal chondrodysplasia.

Correct Answer: Type X collagen/vascular endothelial growth factor A (VEGFA)

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934. (3513) Q2-4467:

Which of the following cells is primarily affected in patients with Gaucher disease:

1) Osteoblast
3) Osteocyte
2) Osteoclast
5) Macrophage
4) Platelet

Gaucher disease is caused by an accumulation of glucocerebrosides (glucosylceramide) in macrophages. The specific enzyme deficiency is glucocerebrosidase (acid beta-glucosidase, lysosomal enzyme). The disease inheritance pattern is autosomal recessive.

Erlenmeyer flask deformities of the metaphyses are a common bone remodeling condition present in patients with Gaucher disease.

Clinical manifestations include pancytopenia, thrombocytopenia, and specific bone conditions such as osteonecrosis, bone crises, and fractures. Patients often have easy bruising and fatigability.

Patients with Gaucher disease are treated by replacement of the deficient enzyme.

Correct Answer: Macrophage

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935. (3514) Q2-4468:

In patients with Gaucher disease, which of the following substances accumulates abnormally in macrophages:

1) Dermatan sulfate
3) Keratin sulfate
2) Heparan sulfate
5) Glucocerebrosides
4) Chondroitin sulfate

Gaucher disease is caused by an accumulation of glucocerebrosides (glucosylceramide) in macrophages. The specific enzyme deficiency is glucocerebrosidase (acid beta-glucosidase, lysosomal enzyme). The disease inheritance pattern is autosomal recessive.

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Patients with Gaucher disease are treated by replacement of the deficient enzyme.

The other answer choices refer to patients with mucopolysaccharidoses:

Syndrome	**Glycosaminoglycans**
Hurler syndrome	Dermatan sulfate and heparan sulfate
Hunter syndrome	Heparan and dermatan sulfate
Sanfilippo syndrome	Heparan sulfate
Morquio syndrome	Keratin sulfate
Maroteaux-Lamy syndrome	Dermatan sulfate

Correct Answer: Glucocerebrosides

936. (3515) Q2-4469:

Which of the following enzyme deficiencies occurs in patients with Gaucher disease:

1) Alpha-L-iduronidase
3) Glucocerebrosidase
2) Beta-glucuronidase
5) Homogentisic acid oxidase
4) Acid phosphatase

Gaucher disease is caused by an accumulation of glucocerebrosides (glucosylceramide) in macrophages. The specific enzyme deficiency is glucocerebrosidase (acid beta-glucosidase, lysosomal enzyme). The disease inheritance pattern is autosomal recessive.

Erlenmeyer flask deformities of the metaphyses are a common bone remodeling condition present in patients with Gaucher disease.

Clinical manifestations include pancytopenia, thrombocytopenia, and specific bone conditions such as osteonecrosis, bone crises, and fractures. Patients often have easy bruising and fatigability.

Patients with Gaucher disease are treated by replacement of the deficient enzyme.

The other answer choices occur in different conditions:

Syndrome	**Enzyme**
Hurler syndrome	Alpha-L-iduronidase
Sly syndrome	Beta-glucuronidase
Alkaptonuria (ochronosis)	Homogentisic acid oxidase

Correct Answer: Glucocerebrosidase

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937. (3516) Q2-4470:

Which of the following is the inheritance pattern of Gaucher disease:

1) Autosomal recessive
3) X-linked dominant
2) Autosomal dominant
5) Sporadic
4) X-linked recessive

Gaucher disease is caused by an accumulation of glucocerebrosides (glucosylceramide) in macrophages. The specific enzyme deficiency is glucocerebrosidase (acid beta-glucosidase, lysosomal enzyme). The disease inheritance pattern is autosomal recessive.

Erlenmeyer flask deformities of the metaphyses are a common bone remodeling condition present in patients with Gaucher disease.

Clinical manifestations include pancytopenia, thrombocytopenia, and specific bone conditions such as osteonecrosis, bone crises, and fractures. Patients often have easy bruising and fatigability.

Patients with Gaucher disease are treated by replacement of the deficient enzyme.

Correct Answer: Autosomal recessive

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938. (3517) Q2-4471:

Which of the following criteria are used to define osteoporosis:

1) Low bone mass, inadequate mineralization, normal micro architecture
3) Normal bone mass, normal mineralization, abnormal micro architecture
2) Low bone mass, normal mineralization, abnormal micro architecture
5) Low bone mass, normal mineralization, normal micro architecture
4) Normal bone mass, abnormal mineralization, abnormal micro architecture

The essential features of osteoporosis include:

- Low bone mass
- Normal mineralization
- Abnormal micro architecture

Osteoporosis is defined by the World Health Organization by comparing a patient's bone mineral density (BMD) to that of patients at the time of peak bone mass (T-score).

- Normal bone mineral density is within 1 SD
- Low bone mass (osteopenia) is between 1 SD and 2.5 SD below mean peak bone mass
- Osteoporosis is more than 2.5 SD below mean peak bone mass

Correct Answer: Low bone mass, normal mineralization, abnormal micro architecture

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939. (3518) Q2-4472:

A 65-year-old woman has a bone mineral density test. Which of the following T-scores is diagnostic of osteoporosis:

1) T-score within 0.5 SD below the mean
3) T-score 1 SD to 2 SD below the mean
2) T-score within 1 SD below the mean
5) T-score more than 2.5 SD below the mean
4) T-score 1 SD to 2.5 SD below the mean

The essential features of osteoporosis include:

- Low bone mass
- Normal mineralization
- Abnormal micro architecture

Osteoporosis is defined by the World Health Organization by comparing a patient's bone mineral density (BMD) to that of patients at the time of peak bone mass (T-score).

- Normal bone mineral density is within 1 SD
- Low bone mass (osteopenia) is between 1.0 SD to 2.5 SD below individuals at peak bone mass
- Osteoporosis is more than 2.5 SD below mean peak bone mass

Correct Answer: T-score more than 2.5 SD below the mean

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940. (3519) Q2-4473:

Which of the following genes have been implicated in the development of osteoporosis:

1) CBFA1, COL2A1, and COMP
3) CBFA1, FGFR3
2) COL10A1, FGFR3
5) COL9A2, COMP, and FGFR3
4) COL1A1, VDR, and LRP5

The essential features of osteoporosis include:

- Low bone mass
- Normal mineralization
- Abnormal micro architecture

The causes of osteoporosis are multifactorial; genetic predisposition may be important. The genes associated with the development of osteoporosis include:

- COL1A1 - Collagen 1 alpha 1 (main bone collagen)
- VDR - Vitamin D receptor
- LRP5 - Low density lipoprotein receptor related protein

The associations of several other genes include:

- CBFA1 - Cleidocranial dysplasia
- COL2A1 - Achondrogenesis
- COMP - Multiple epiphyseal dysplasia
- COL10A1 - Schmid metaphyseal chondrodysplasia
- FGFR3 - Achondroplasia
- COL9A2 - Multiple epiphyseal dysplasia

Correct Answer: COL1A1, VDR, and LRP5

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941. (3520) Q2-4474:

Which of the following dosages are correct in regard to the necessary daily calcium and vitamin D intake in patients between 19 and 50 years of age:

1) Calcium 1000 mg; vitamin D 400 IU
3) Calcium 1200 mg; vitamin D 200 IU
2) Calcium 1600 mg; vitamin D 400 IU
5) Calcium 2000 mg; vitamin D 1000 IU to 2000 IU
4) Calcium 1400 mg; vitamin D 400 IU

Appropriate amounts of calcium and vitamin D are crucial for good bone health. All therapeutic interventions for patients with osteoporosis require that calcium and vitamin D intake are adequate. The current recommendations for calcium and vitamin D are:

- Ages 10-19 â Calcium 1000 mg; vitamin D 200 IU
- Ages 19-50 â Calcium 1200 mg; vitamin D 200 IU
- Ages 50-79 â Calcium 1400 mg; vitamin D 400 IU
- Osteoporotic patient â Calcium 2000 mg; vitamin D 1000 IU to 2000 IU

Correct Answer: Calcium 1200 mg; vitamin D 200 IU

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942. (3521) Q2-4475:

Which of the following are the correct daily intakes of calcium and vitamin D in a 60-year-old patient with no evidence of osteoporosis:

1) Calcium 1000 mg; vitamin D 400 IU
3) Calcium 1200 mg; vitamin D 200 IU
2) Calcium 1600 mg; vitamin D 400 IU
5) Calcium 2000 mg, vitamin D 1000 IU to 2000 IU
4) Calcium 1400 mg; vitamin D 400 IU

Appropriate amounts of calcium and vitamin D are crucial for good bone health. All therapeutic interventions for patients with osteoporosis require that calcium and vitamin D intake are adequate. The current recommendations for calcium and vitamin D are:

- Ages 10-19â Calcium 1000 mg; vitamin D 200 IU
- Ages 19-50 â Calcium 1200 mg; vitamin D 200 IU
- Ages 50-79 â Calcium 1400 mg; vitamin D 400 IU
- Osteoporotic patient â Calcium 2000 mg; vitamin D 1000 IU to 2000 IU

Correct Answer: Calcium 1400 mg; vitamin D 400 IU

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943. (3522) Q2-4476:

Which of the following is the correct daily dietary intake of calcium and vitamin D in a patient older than 65 years of age with osteoporosis:

1) Calcium 1000 mg; vitamin D 400 IU
3) Calcium 1200 mg; vitamin D 200 IU
2) Calcium 1600 mg; vitamin D 400 IU
5) Calcium 2000 mg; vitamin D 1000 IU to 2000 IU
4) Calcium 1400 mg; vitamin D 400 IU

Appropriate amounts of calcium and vitamin D are crucial for good bone health. All therapeutic interventions for patients with osteoporosis require that calcium and vitamin D intake are adequate. The current recommendations for calcium and vitamin D are:

- Ages 10-19 â Calcium 1000 mg; vitamin D 200 IU
- Ages 19-50 â Calcium 1200 mg; vitamin D 200 IU
- Ages 50-79 â Calcium 1400 mg; vitamin D 400 IU
- Osteoporotic patient â Calcium 2000 mg; vitamin D 1000 IU to 2000 IU

Correct Answer: Calcium 2000 mg; vitamin D 1000 IU to 2000 IU

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944. (3523) Q2-4477:

Which of the following therapies has an anabolic effect on bone (increases bone mass) in the treatment of women with postmenopausal osteoporosis:

1) Oral bisphosphonates
3) Subcutaneous parathyroid hormone (PTH)
2) Parenteral bisphosphonates
5) Oral vitamin D supplementation
4) Nasal calcitonin

Parathyroid hormone is the only FDA-approved anabolic method for the treatment of osteoporosis. Parathyroid hormone causes bone resorption and bone formation. The net effect is an increase in bone formation.

The indications for PTH therapy include:

- High-risk patients for fracture (bone mineral density, T-score less than -3.0)
- Patients with refractory osteoporosis
- Patients who cannot tolerate treatment with other methods

The contraindications to PTH therapy include:

- Patients at risk for developing osteosarcoma
    - Pagetâs disease
    - Following irradiation of bone
- Children with open physes
- Patients with hyperparathyroidism
- Patients with metastatic bone disease

Correct Answer: Subcutaneous parathyroid hormone (PTH)

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945. (3524) Q2-4478:

Which of the following therapies also has a significant analgesic effect in the treatment of women with postmenopausal osteoporosis:

1) Oral bisphosphonate
3) Subcutaneous parathyroid hormone
2) Parenteral bisphosphonate
5) Oral vitamin D supplementation
4) Nasal calcitonin

Calcitonin is produced by the C cells of the thyroid gland. Although the exact physiologic function of calcitonin is unknown, this hormone has a powerful inhibitory effect on the osteoclast.

The effects of calcitonin on the osteoclast include:

- Flattening of the ruffled border
- Withdrawal of the osteoclast from the bone surface

Calcitonin can be used as a treatment for osteoporosis. Salmon calcitonin is given intranasally. In addition to inhibiting bone resorption, there is a significant analgesic effect, especially in osteoporotic patients with vertebral fractures.

Correct Answer: Nasal calcitonin

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946. (3525) Q2-4479:

Which of the following complications may occur following bisphosphonate therapy:

1) Increase in hip fractures
3) Increase in falls
2) Increase in vertebral fractures
5) Impaired fracture healing
4) Osteonecrosis of the jaw

A rare, but significant, skeletal complication of bisphosphonate therapy is osteonecrosis of the jaw. Osteonecrosis of the jaw occurs more commonly in patients with metastatic bone disease who receive monthly treatments and tends to occur following major dental work. Patients should be queried about the condition of their teeth prior to starting bisphosphonate therapy.Correct Answer: Osteonecrosis of the jaw

947. (3526) Q2-4480:

The mechanism of action of nitrogen-containing bisphosphonates is:

1) Toxic analogs of adenosine triphosphate (ATP)
3) Increased production of osteoprotegerin
2) Inhibition of protein prenylation
5) Decreased production of RANK receptor
4) Decreased production of receptor activator of nuclear factor-kB ligand (RANKL)

The mechanism of action of nitrogen-containing bisphosphonates is inhibition of protein prenylation. These agents cause programmed cell death of the osteoclast (apoptosis).

The nitrogen-containing bisphosphonates specifically inhibit farnesyl pyrophosphatase and prevent post-translational prenylation of guanosine triphosphate-binding proteins. Nitrogen-containing bisphosphonates disrupt the ruffled border and microtubules of the osteoclast.

The non-nitrogen containing bisphosphonates (etidronate, clodronate) produce toxic analogs of ATP.

Correct Answer: Inhibition of protein prenylation

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948. (3527) Q2-4481:

Which of the following is the most common adverse effect of bisphosphonate therapy:

1) Osteonecrosis of the jaw
3) Fever and myalgia
2) Hypocalcemia
5) Diarrhea
4) Pruritic rash

The most common adverse effect of bisphosphonate therapy is fever and myalgia. When taken orally, bisphosphonates must be taken while fasting, with 8 oz of water, and the patient must remain upright for 30 minutes. Because these medications may cause esophageal irritation and possible erosion, they must be used carefully or not at all in patients with disorders of esophageal motility.

A rare, but significant, skeletal complication of bisphosphonate therapy is osteonecrosis of the jaw. Osteonecrosis of the jaw occurs more commonly in patients with metastatic bone disease who receive monthly treatments and tends to occur following major dental work. Patients should be queried about the condition of their teeth prior to starting bisphosphonate therapy.

Correct Answer: Fever and myalgia

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949. (3528) Q2-4482:

Parathyroid hormone (PTH) therapy is contraindicated in which of the following patients:

1) Patients with refractory postmenopausal osteoporosis
3) Patients with bone loss following anti-resorptive therapies
2) Patients at high risk for osteoporotic fractures
5) Men at high risk for osteoporotic fractures
4) Patients with Pagetâs disease

Parathyroid hormone is the only FDA-approved anabolic method for the treatment of osteoporosis. Parathyroid hormone causes bone resorption and bone formation. The net effect is an increase in bone formation.

The indications for PTH therapy include:

- High-risk patients for fracture (bone mineral density, T-score less than -3.0)
- Patients with refractory osteoporosis
- Patients who cannot tolerate treatment with other methods

The contraindications to PTH therapy include:

- Patients at risk for developing osteosarcoma
    - Pagetâs disease
    - Following irradiation of bone
- Children with open physes
- Patients with hyperparathyroidism
- Patients with metastatic bone disease

Correct Answer: Patients with Pagetâs disease

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950. (3529) Q2-4483:

Diphosphonates are contraindicated in patients with which of the following conditions:

1) Pagetâs disease
3) Hypocalcemia
2) Postmenopausal osteoporosis
5) Polyostotic fibrous dysplasia
4) Multiple myeloma

The mechanism of action of nitrogen-containing bisphosphonates is inhibition of protein prenylation. These agents cause programmed cell death of the osteoclast (apoptosis).

The nitrogen-containing bisphosphonates specifically inhibit farnesyl pyrophosphatase and prevent post-translational prenylation of guanosine triphosphate-binding proteins. Nitrogen-containing bisphosphonates disrupt the ruffled border and microtubules of the osteoclast.

Diphosphonates halt the osteoclast from resorbing bone and increasing the serum calcium level by resorbing bone and releasing the inorganic matrix. **Diphosphonates are contraindicated in patients with hypocalcemia because they further lower the serum calcium level**.

Diphosphonates are used in the treatment of:

- Pagetâs disease
- Postmenopausal osteoporosis
- Multiple myeloma
- Metastatic bone disease
- Polyostotic fibrous dysplasia

Correct Answer: Hypocalcemia

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951. (3530) Q2-4484:

The mechanism of action of nitrogen-containing bisphosphonates is:

1) Osteoblast activation
3) Osteoclast apoptosis
2) Osteocyte activation
5) Increased production of osteoprotegerin
4) Decreased production of receptor activator of nuclear factor-kB ligand (RANKL)

The mechanism of action of nitrogen-containing bisphosphonates is inhibition of protein prenylation. These agents cause programmed cell death of the osteoclast (apoptosis).

The nitrogen-containing bisphosphonates specifically inhibit farnesyl pyrophosphatase and prevent post-translational prenylation of guanosine triphosphate-binding proteins. Nitrogen-containing bisphosphonates disrupt the ruffled border and microtubules of the osteoclast.

Diphosphonates halt the osteoclast from resorbing bone and increasing the serum calcium level by resorbing bone and releasing the inorganic matrix. Diphosphonates are contraindicated in patients with hypocalcemia because they further lower the serum calcium level.

Diphosphonates do not influence RANKL or osteoprotegerin function or production.

Correct Answer: Osteoclast apoptosis

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952. (3531) Q2-4485:

The mechanism of action of nitrogen-containing bisphosphonates is:

1) Toxic analogs of adenosine triphosphate
3) Increased production of osteoprotegerin
2) Decreased production of receptor activator of nuclear factor-kB ligand (RANKL)
5) Inhibition of farnesyl pyrophosphatase
4) Decreased production of RANK receptor

The mechanism of action of nitrogen-containing bisphosphonates is inhibition of protein prenylation. These agents cause programmed cell death of the osteoclast (apoptosis).

The nitrogen-containing bisphosphonates specifically inhibit farnesyl pyrophosphatase and prevent post-translational prenylation of guanosine triphosphate-binding proteins. Nitrogen-containing bisphosphonates disrupt the ruffled border and microtubules of the osteoclast.

Diphosphonates halt the osteoclast from resorbing bone and increasing the serum calcium level by resorbing bone and releasing the inorganic matrix. Diphosphonates are contraindicated in patients with hypocalcemia because they further lower the serum calcium level.

Diphosphonates do not influence RANKL or osteoprotegerin function or production.

Correct Answer: Inhibition of farnesyl pyrophosphatase

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953. (3532) Q2-4486:

All of the following are significant risk factors for osteoporosis except:

1) White race
3) Low height
2) Low body weight
5) Maternal/paternal history of a hip fracture
4) Glucocorticoid use

The most important risk factors for osteoporosis are:

- Increasing age (geriatric patient)
- Female gender
- Early menopause
- White race (fair-skinned individuals)
- Maternal/paternal history of hip fracture
- Low body weight
- Cigarette smoking
- Glucocorticoid use
- Excessive alcohol use
- Low protein intake
- Anticonvulsant, antidepressant use

Correct Answer: Low height

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954. (3533) Q2-4487:

Which of the following are the most significant risk factors for osteoporosis:

1) Increasing age, female gender, low body weight
3) Increasing age, black race, male gender
2) Increasing age, female gender, high body weight
5) Male gender, white race, high body weight
4) Male gender, black race, high body weight

The most important risk factors for osteoporosis are:

- Increasing age (geriatric patient)
- Female gender
- Early menopause
- White race (fair-skinned individuals)
- Maternal/paternal history of hip fracture
- Low body weight
- Cigarette smoking
- Glucocorticoid use
- Excessive alcohol use
- Low protein intake
- Anticonvulsant, antidepressant use

Correct Answer: Increasing age, female gender, low body weight

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955. (3534) Q2-4488:

All of the following are significant risk factors for osteoporosis except:

1) White race
3) Low height
2) Low body weight
5) Maternal/paternal history of hip fracture
4) Glucocorticoid use

The most important risk factors for osteoporosis are:

- Increasing age (geriatric patient)
- Female gender
- Early menopause
- White race (fair-skinned individuals)
- Maternal/paternal history of hip fracture
- Low body weight
- Cigarette smoking
- Glucocorticoid use
- Excessive alcohol use
- Low protein intake
- Anticonvulsant, antidepressant use

Correct Answer: Low height

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956. (3535) Q2-4489:

Which of the following is a significant risk factor for osteoporosis:

1) Black race
3) Low height
2) High body weight
5) High protein intake
4) Glucocorticoid use

The most important risk factors for osteoporosis are:

- Increasing age (geriatric patient)
- Female gender
- Early menopause
- White race (fair-skinned individuals)
- Maternal/paternal history of hip fracture
- Low body weight
- Cigarette smoking
- Glucocorticoid use
- Excessive alcohol use
- Low protein intake
- Anticonvulsant, antidepressant use

Correct Answer: Glucocorticoid use

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957. (3536) Q2-4490:

Which of the following is a significant risk factor for osteoporosis:

1) Black race
3) Low height
2) High body weight
5) Maternal/paternal history of hip fracture
4) High protein intake

The most important risk factors for osteoporosis are:

- Increasing age (geriatric patient)
- Female gender
- Early menopause
- White race (fair-skinned individuals)
- Maternal/paternal history of hip fracture
- Low body weight
- Cigarette smoking
- Glucocorticoid use
- Excessive alcohol use
- Low protein intake
- Anticonvulsant, antidepressant use

Correct Answer: Maternal/paternal history of hip fracture

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958. (3537) Q2-4491:

Which of the following are significant risk factors for osteoporosis:

1) Increasing age, high body weight, female gender
3) Increasing age, low body weight, white race
2) Increasing age low body weight, male gender
5) Female gender, black race, high body weight
4) Female gender, white race, high body weight

The most important risk factors for osteoporosis are:

- Increasing age (geriatric patient)
- Female gender
- Early menopause
- White race (fair-skinned individuals)
- Maternal/paternal history of hip fracture
- Low body weight
- Cigarette smoking
- Glucocorticoid use
- Excessive alcohol use
- Low protein intake
- Anticonvulsant, antidepressant use

Correct Answer: Increasing age, low body weight, white race

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959. (3538) Q2-4492:

Peak bone mass is typically achieved by:

1) 10 to 20 years of age
3) 30 to 40 years of age
2) 20 to 30 years of age
5) 50 to 60 years of age
4) 40 to 50 years of age

Peak bone mass is achieved when puberty ends, usually between 20 and 30 years of age. Skeletal health is dependent upon peak bone mass because bone mass declines as an individual ages.

The greatest period of bone loss is the time of estrogen withdrawal in women. A decrease in estrogen levels has several consequences, including:

- Decreased renal calcium absorption
- Decreased calcium absorption

Correct Answer: 20 to 30 years of age

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960. (3702) Q2-7482:

Which of the following is false concerning fibroblast growth factor receptor 3 (FGFR3) physiology and related disorders:

1) Autosomal recessive inheritance
3) 70% are new mutations
2) Gain in function mutations
5) Ligand binding results in phosphorylation of the tyrosine kinase domain
4) Receptor is active even without ligand binding

I. Important facts concerning FGFR3 physiology and disorders

A. Gain in function mutation results in achondroplasia
    1. Point mutation
    2. Homogenous (single, constant amino acid change)
    3. Receptor is active even without ligand binding
    4. Autosomal dominant
B. Regulates cell growth, proliferation, and differentiation
C. Ligand binding results in phosphorylation of the tyrosine kinase domain
D. Activation of the receptor limits enchondral ossification
E. Deficiency of the receptor results in elongation of the vertebral column and long bones (knockout mice)

Correct Answer: Autosomal recessive inheritance

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961. (3703) Q2-7483:

Which of the following is true concerning fibroblast growth factor receptor 3 (FGFR3) physiology and related disorders:

1) Autosomal recessive inheritance
3) Majority of patients with achondroplasia have an inherited mutation
2) Loss of function mutation
5) Receptor activation enhances enchondral ossification
4) Receptor is active even without ligand binding

I. Important facts concerning FGFR3 physiology and disorders

A. Gain in function mutation results in achondroplasia
    1. Point mutation
    2. Homogenous (single, constant amino acid change)
    3. Receptor is active even without ligand binding
    4. Autosomal dominant
B. Regulates cell growth, proliferation, and differentiation
C. Ligand binding results in phosphorylation of the tyrosine kinase domain
D. Activation of the receptor limits enchondral ossification
E. Deficiency of the receptor results in elongation of the vertebral column and long bones (knockout mice)

Correct Answer: Receptor is active even without ligand binding

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962. (3704) Q2-7484:

Which of the following is true concerning fibroblast growth factor receptor 3 (FGFR3) physiology and related disorders:

1) Autosomal recessive inheritance
3) Majority of patients with achondroplasia have an inherited mutation
2) Gain of function mutation
5) Receptor activation enhances enchondral ossification
4) Heterogeneous disorder with many different mutations

I. Important facts concerning FGFR3 physiology and disorders

A. Gain in function mutation results in achondroplasia
    1. Point mutation
    2. Homogenous (single, constant amino acid change)
    3. Receptor is active even without ligand binding
    4. Autosomal dominant
B. Regulates cell growth, proliferation, and differentiation
C. Ligand binding results in phosphorylation of the tyrosine kinase domain
D. Activation of the receptor limits enchondral ossification
E. Deficiency of the receptor results in elongation of the vertebral column and long bones (knockout mice)

Correct Answer: Gain of function mutation

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963. (3705) Q2-7485:

Which of the following is false concerning fibroblast growth factor receptor 3 (FGFR3) physiology and related disorders:

1) Autosomal dominant inheritance
3) 70% are new mutations
2) Gain in function mutations
5) Ligand binding results in phosphorylation of the tyrosine kinase domain
4) Receptor activation enhances enchondral ossification

I. Important facts concerning FGFR3 physiology and disorders

A. Gain in function mutation results in achondroplasia
    1. Point mutation
    2. Homogenous (single, constant amino acid change)
    3. Receptor is active even without ligand binding
    4. Autosomal dominant
B. Regulates cell growth, proliferation, and differentiation
C. Ligand binding results in phosphorylation of the tyrosine kinase domain
D. Activation of the receptor limits enchondral ossification
E. Deficiency of the receptor results in elongation of the vertebral column and long bones (knockout mice)

Correct Answer: Receptor activation enhances enchondral ossification

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964. (3706) Q2-7486:

Which of the following is false concerning fibroblast growth factor receptor 3 (FGFR3) physiology and related disorders:

1) Autosomal dominant inheritance
3) 70% are new mutations
2) Loss in function mutations
5) Ligand binding results in phosphorylation of the tyrosine kinase domain
4) Receptor activation limits enchondral ossification

I. Important facts concerning FGFR3 physiology and disorders

A. Gain in function mutation results in achondroplasia
    1. Point mutation
    2. Homogenous (single, constant amino acid change)
    3. Receptor is active even without ligand binding
    4. Autosomal dominant
B. Regulates cell growth, proliferation, and differentiation
C. Ligand binding results in phosphorylation of the tyrosine kinase domain
D. Activation of the receptor limits enchondral ossification
E. Deficiency of the receptor results in elongation of the vertebral column and long bones (knockout mice)

Correct Answer: Loss in function mutations

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965. (3707) Q2-7487:

Which of the following genetic disorders has the greatest degree of homogeneity (homogenous mutation):

1) Osteogenesis imperfecta
3) Spondyloepiphyseal dysplasia
2) Multiple epiphyseal dysplasia
5) Osteopetrosis
4) Achondroplasia

II. Achondroplasia is the most homogeneous disorder in regard to the point mutation (single amino acid point mutation – arginine to glycine)

A. The defect is a gain in function of the FGFR3
B. FGFR3 regulates bone growth by limiting enchondral ossification
C. The phenotype of achondroplasia is:
    1. Varus knee deformity
    2. Spinal stenosis
    3. Atlantoaxial instability

Correct Answer: Achondroplasia

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966. (3708) Q2-7488:

Which of the following is the function of fibroblast growth factor receptor 3 (FGFR3):

1) Cartilage cell proliferation and migration (through calcium-dependent proteoglycan binding)
3) Transport of sulfate into cells
2) Regulates bone growth by limiting enchondral ossification
5) Tumor-suppressor gene to control cell growth and differentiation
4) Formation of structural glycoprotein for elastin-containing micro-fibrils

Fibroblast growth factor receptor 3 regulates bone growth by limiting enchondral ossification.

The other responses refer to:

- Cartilage oligomeric matrix protein (COMP): Cartilage cell proliferation and migration (through calcium-dependent proteoglycan binding)
- Diastrophic dysplasia sulfate transporter gene (DTDST): Transport of sulfate into cells; needed for proteoglycan production
- Fibrillin (FBN1): Formation of structural glycoprotein (fibrillin) for elastin-containing micro-fibrils
- Neurofibromin (NF-1) - tumor suppressor gene to control cell growth and differentiation; negatively regulates the gene RAS
    - RAS causes cell proliferation

Correct Answer: Regulates bone growth by limiting enchondral ossification

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967. (3709) Q2-7489:

Which of the following phenotypes occurs in patients with achondroplasia:

1) CafÃ© au lait spots, pseudoarthrosis of tibia, and scoliosis
3) Proximal muscle weakness and calf hypertrophy
2) Cavovarus feet, areflexia, and distal motor wasting
5) Knee varus and spinal stenosis
4) Dolichostenomelia and scoliosis

The phenotype of achondroplasia includes:

- Varus knee deformity
- Spinal stenosis
- Atlantoaxial instability

The other responses:

- Neurofibromatosis: CafÃ© au lait spots, pseudoarthrosis of tibia and scoliosis
- Charcot-Marie-Tooth disease: Cavovarus feet, areflexia, and distal motor wasting
- Duchenne muscular dystrophy: Proximal muscle weakness and calf hypertrophy
- Marfanâs syndrome: Dolichostenomelia and scoliosis

Correct Answer: Knee varus and spinal stenosis

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968. (3710) Q2-7490:

In a mouse model, if the gene for fibroblast growth factor receptor 3 (FGFR3) is knocked out, which of the following occurs:

1) Marked inhibition of enchondral ossification
3) Marked decrease in sulfate transport into the cells
2) Absence of bilateral clavicles
5) Defects in limb development and patterning (synpolydactyly)
4) Increased vertebral height and long bone length

I. Important facts concerning fibroblast growth factor receptor 3 (FGFR3) physiology and disorders

A. Gain in function mutation results in achondroplasia
    1. Point mutation
    2. Homogenous (single, constant amino acid change)
    3. Receptor is active even without ligand binding
    4. Autosomal dominant
B. Regulates cell growth, proliferation, and differentiation
C. Ligand binding results in phosphorylation of the tyrosine kinase domain
D. Activation of the receptor limits enchondral ossification
E. Deficiency of the receptor results in elongation of the vertebral column and long bones (knockout mice)

II. The other responses

A. Runx2 (Cbaf1) deficiency: Cleidocranial dysplasia, absent clavicles
B. Diastrophic dysplasia sulfate transporter gene (DTDST): Transport of sulfate into cells; needed for proteoglycan production
C. Hoxd-13 deficiency: Defects in development and patterning limb, results in synpolydactyly

Correct Answer: Increased vertebral height and long bone length

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969. (3711) Q2-7491:

Which of the following mutations occurs in patients with achondroplasia?

1) Mutation in Type I collagen gene
3) Mutation in the sulfate transporter gene
2) Mutation in the fibrillin gene
5) Mutation in fibroblast growth factor receptor 3 gene
4) Mutation in Type IX collagen gene

One should remember the important mutations that occur in musculoskeletal conditions:

A. FGFR3 mutation: Achondroplasia
B. Type IX collagen mutation: Multiple epiphyseal dysplasia (MED)
C. WISP3 mutation: Spondyloepiphyseal dysplasia with progressive osteoarthropathy
D. Type II collagen mutation: Stickler syndrome
E. Sulfate transporter gene mutation: Diastrophic dysplasia
F. Fibrillin gene mutation: Marfanâs syndrome
G. Type V collagen mutation: Ehlers-Danlos syndrome
H. Type I collagen mutation: Osteogenesis imperfecta

Correct Answer: Mutation in fibroblast growth factor receptor 3 gene

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970. (3712) Q2-7492:

Which of the following mutations occurs in patients with Ehlers-Danlos syndrome:

1) FGFR3 mutation
3) Type V collagen mutation
2) Type II collagen mutation
5) Type IX collagen mutation
4) Sulfate transporter gene mutation

One should remember the important mutations that occur in musculoskeletal conditions:

- FGFR3 mutation: Achondroplasia
- Type IX collagen mutation: Multiple epiphyseal dysplasia (MED)
- WISP3 mutation: Spondyloepiphyseal dysplasia with progressive osteoarthropathy
- Type II collagen mutation: Stickler syndrome
- Sulfate transporter gene mutation: Diastrophic dysplasia
- Fibrillin gene mutation: Marfanâs syndrome
- Type V collagen mutation: Ehlers-Danlos syndrome
- Type I collagen mutation: Osteogenesis imperfecta

Correct Answer: Type V collagen mutation

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971. (3713) Q2-7493:

Which of the following mutations occurs in patients with diastrophic dysplasia:

1) Type II collagen mutation
3) Type I collagen mutation
2) Type V collagen mutation
5) Fibrillin gene mutation
4) Sulfate transporter gene mutation

One should remember the important mutations that occur in musculoskeletal conditions:

- FGFR3 mutation: Achondroplasia
- Type IX collagen mutation: Multiple epiphyseal dysplasia (MED)
- WISP3 mutation: Spondyloepiphyseal dysplasia with progressive osteoarthropathy
- Type II collagen mutation: Stickler syndrome
- Sulfate transporter gene mutation: Diastrophic dysplasia
- Fibrillin gene mutation: Marfanâs syndrome
- Type V collagen mutation: Ehlers-Danlos syndrome
- Type I collagen mutation: Osteogenesis imperfecta

Correct Answer: Sulfate transporter gene mutation

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972. (3714) Q2-7494:

Which of the following mutations occurs in patients with spondyloepiphyseal dysplasia with progressive osteoarthropathy:

1) Type IX collagen mutation
3) Type I collagen mutation
2) Type II collagen mutation
5) WISP3 mutation
4) Type V collagen mutation

One should remember the important mutations that occur in musculoskeletal conditions:

- FGFR3 mutation: Achondroplasia
- Type IX collagen mutation: Multiple epiphyseal dysplasia (MED)
- WISP3 mutation: Spondyloepiphyseal dysplasia with progressive osteoarthropathy
- Type II collagen mutation: Stickler syndrome
- Sulfate transporter gene mutation: Diastrophic dysplasia
- Fibrillin gene mutation: Marfanâs syndrome
- Type V collagen mutation: Ehlers-Danlos syndrome
- Type I collagen mutation: Osteogenesis imperfecta

Correct Answer: WISP3 mutation

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973. (3715) Q2-7495:

Which of the following mutations occurs in patients with Stickler syndrome:

1) FGFR3 mutation
3) Type II collagen mutation
2) Type IX collagen mutation
5) Type I collagen mutation
4) Type V collagen mutation

One should remember the important mutations that occur in musculoskeletal conditions:

- FGFR3 mutation: Achondroplasia
- Type IX collagen mutation: Multiple epiphyseal dysplasia (MED)
- WISP3 mutation: Spondyloepiphyseal dysplasia with progressive osteoarthropathy
- Type II collagen mutation: Stickler syndrome
- Sulfate transporter gene mutation: Diastrophic dysplasia
- Fibrillin gene mutation: Marfanâs syndrome
- Type V collagen mutation: Ehlers-Danlos syndrome
- Type I collagen mutation: Osteogenesis imperfecta

Correct Answer: Type II collagen mutation

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974. (3716) Q2-7496:

Which of the following is true concerning the genetics of arthritis:

1) Siblings have a 27% risk compared to spouses
3) Precocious osteoarthritis is not associated with type V collagen mutation
2) Equal risk in monozygotic twins compared to dizygotic twins
5) Distal interphalangeal joint arthritis is linked to trauma rather than a genetic foci
4) Occurs in all patients with aging hip joints

One should remember the genetic findings in patients with osteoarthritis:

- Siblings have a 27% risk compared to spouses
- Twice as common in monozygotic twins compared to dizygotic twins
- Precocious osteoarthritis is associated with type V collagen mutation
- Does not occur universally in aging hip joints
- Distal interphalangeal joint arthritis linked to a region of chromosome 2q

Correct Answer: Siblings have a 27% risk compared to spouses

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975. (3717) Q2-7497:

Which of the following disorders has a sex-linked inheritance pattern and is caused by a point mutation in the short stature homeobox-containing gene:

1) Achondroplasia
3) Diastrophic dysplasia
2) Turnerâs syndrome
5) Multiple epiphyseal dysplasia
4) Cleidocranial dysplasia

There are a set of disorders with a sex-linked inheritance pattern that are most likely caused by a point mutation in the short stature homeobox gene. These disorders include:

- Turnerâs syndrome
- Langer mesomelic dysplasia
- Leri-Weill dyschondrosteosis

The other responses refer to common disorders with well-documented genetic abnormalities:

- Achondroplasia: FGFR3
- Diastrophic dysplasia: DTDST (sulfate transporter gene)
- Cleidocranial dysplasia: CBFA1
- Multiple epiphyseal dysplasia: COMP

Correct Answer: Turnerâs syndrome

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976. (3718) Q2-7498:

A mutation in which of the following genes causes a disturbance in normal limb outgrowth patterning:

1) CBFA1
3) COL1A1
2) COMP
5) VDR3
4) P63

P63 is an important factor in normal limb outgrowth patterning. The other factors are involved with common disorders:

- CBFA1: Cleidocranial dysplasia
- COMP: Multiple epiphyseal dysplasia
- COL1A1: Osteogenesis imperfecta (easy to remember type I collagen)
- VDR3: Osteoporosis (easy to remember vitamin D receptor)

Correct Answer: P63

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977. (3719) Q2-7499:

A prospective, randomized study of the use of intravenous bisphosphonate therapy following a hip fracture (control = no bisphosphonate; study group = annual zoledronic acid) would most likely yield the following outcome:

1) No difference in subsequent osteoporotic fractures
3) Reduction in nonvertebral fractures; no reduction in vertebral fractures
2) Reduction in vertebral fractures; no reduction in nonvertebral fractures
5) Equal death rate in the study and control groups
4) Reduction in vertebral and nonvertebral fractures

A large prospective, randomized study showed a reduction in vertebral and nonvertebral fractures when patients were treated with intravenous (IV) zoledronic acid within 90 days of a hip fracture, followed up with annual treatment.

Important points to remember about this study:

- Study: Zoledronic acid (5 mg, IV) within 90 days of hip fracture and then annually (1,000 patients in each group)
- New fractures: 8.6% vs 13.9% (absolute risk reduction, 5.3%; relative risk reduction, 35%)
- New fractures

  Â Â o Â Â Vertebral: 1.7% vs 3.8% (*P* = .02)
  Â Â o Â Â Nonvertebral: 7.6% vs 10.7% (*P* = .03)
  Â Â o Â Â Hip: 2.0% vs 3.5% (relative risk 30%, not significant)
  Â Â o Â Â Divergence of fracture-free survival at 12 months
- BMD

  Â Â o Â Â 12 month: 2.6% vs -1.0%
  Â Â o Â Â 24 month: 4.7% vs -0.7%
  Â Â o Â Â 36 month: 5.5% vs -0.9%
- Death

  Â Â o Â Â Hazard ratio: -0.72 (0.56 to 0.93 CI, *P* = .01)
- Adverse advents

  Â Â o Â Â Pyrexia: 8.7% vs 3.1%
  Â Â o Â Â Myalgia: 4.9% vs 2.7%
  Â Â o Â Â Bone pain: 3.2% vs 1.0%

Correct Answer: Reduction in vertebral and nonvertebral fractures

978. (3720) Q2-7500:

A prospective, randomized study of the use of intravenous bisphosphonate therapy following a hip fracture (control = no bisphosphonate; study group = annual zoledronic acid) would most likely yield the following outcome:

1) Decrease in new fractures; no improvement in bone mineral density (BMD)
3) No difference in new fractures; no difference in survival
2) No difference in new fractures; no improvement in BMD
5) No difference in fracture-free survival; no difference in vertebral fractures
4) Decrease in new fractures; survival advantage

A large prospective, randomized study showed a reduction in vertebral and nonvertebral fractures when patients were treated with intravenous (IV) zoledronic acid within 90 days of a hip fracture, followed up with annual treatment.

Important points to remember about this study:

- Study: Zoledronic acid (5 mg, IV) within 90 days of hip fracture and then annually (1,000 patients in each group)
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  Â Â o Â Â Divergence of fracture-free survival at 12 months
- BMD

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  Â Â o Â Â 36 month: 5.5% vs -0.9%
- Death

  Â Â o Â Â Hazard ratio: -0.72 (0.56 to 0.93 CI, *P* = .01)
- Adverse advents

  Â Â o Â Â Pyrexia: 8.7% vs 3.1%
  Â Â o Â Â Myalgia: 4.9% vs 2.7%
  Â Â o Â Â Bone pain: 3.2% vs 1.0%

Correct Answer: Decrease in new fractures; survival advantage

979. (3721) Q2-7501:

Patients treated with zoledronic acid within 90 days of a hip fracture, followed up with annual treatment, will most likely show:

1) Decreased vertebral fractures, no difference in nonvertebral fracture, and no difference in survival
3) No difference in vertebral and nonvertebral fracture and no difference in survival
2) Decreased vertebral fractures, decreased nonvertebral fracture, and improved survival
5) Decreased fracture rate but no difference in survival or BMD
4) Improved bone mineral density (BMD) but no difference in fracture rate

A large prospective, randomized study showed a reduction in vertebral and nonvertebral fractures when patients were treated with intravenous (IV) zoledronic acid within 90 days of a hip fracture, followed up with annual treatment.

Important points to remember about this study:

- Study: Zoledronic acid (5 mg, IV) within 90 days of hip fracture and then annually (1,000 patients in each group)
- New fractures: 8.6% vs 13.9% (absolute risk reduction, 5.3%; relative risk reduction, 35%)
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  Â Â o Â Â Nonvertebral: 7.6% vs 10.7% (*P* = .03)
  Â Â o Â Â Hip: 2.0% vs 3.5% (relative risk 30%, not significant)
  Â Â o Â Â Divergence of fracture-free survival at 12 months
- BMD

  Â Â o Â Â 12 month: 2.6% vs -1.0%
  Â Â o Â Â 24 month: 4.7% vs -0.7%
  Â Â o Â Â 36 month: 5.5% vs -0.9%
- Death

  Â Â o Â Â Hazard ratio: -0.72 (0.56 to 0.93 CI, *P* = .01)
- Adverse advents

  Â Â o Â Â Pyrexia: 8.7% vs 3.1%
  Â Â o Â Â Myalgia: 4.9% vs 2.7%
  Â Â o Â Â Bone pain: 3.2% vs 1.0%

Correct Answer: Decreased vertebral fractures, decreased nonvertebral fracture, and improved survival

980. (3722) Q2-7502:

Which of the following is the most common adverse event from intravenous bisphosphonate therapy:

1) Osteonecrosis of the jaw
3) Nausea and vomiting
2) Esophageal irritation and dyspepsia
5) Pruritic rash
4) Pyrexia and myalgia

A large prospective, randomized study showed a reduction in vertebral and nonvertebral fractures when patients were treated with intravenous (IV) zoledronic acid within 90 days of a hip fracture, followed up with annual treatment.

Important points to remember about this study:

- Study: Zoledronic acid (5 mg, IV) within 90 days of hip fracture and then annually (1,000 patients in each group)
- New fractures: 8.6% vs 13.9% (absolute risk reduction, 5.3%; relative risk reduction, 35%)
- New fractures

  Â Â o Â Â Vertebral: 1.7% vs 3.8% (*P* = .02)
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  Â Â o Â Â Hip: 2.0% vs 3.5% (relative risk 30%, not significant)
  Â Â o Â Â Divergence of fracture-free survival at 12 months
- BMD

  Â Â o Â Â 12 month: 2.6% vs -1.0%
  Â Â o Â Â 24 month: 4.7% vs -0.7%
  Â Â o Â Â 36 month: 5.5% vs -0.9%
- Death

  Â Â o Â Â Hazard ratio: -0.72 (0.56 to 0.93 CI, *P* = .01)
- Adverse advents

  Â Â o Â Â Pyrexia: 8.7% vs 3.1%
  Â Â o Â Â Myalgia: 4.9% vs 2.7%
  Â Â o Â Â Bone pain: 3.2% vs 1.0%

Correct Answer: Pyrexia and myalgia

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981. (3723) Q2-7503:

A 65-year-old woman sustains a hip fracture following a minor fall. Which of the following treatments should be considered:

1) A. Hormone replacement therapy
3) Antiresorptive therapy
2) Intermittent parathyroid hormone therapy
5) Calcium and vitamin D supplementation and repeat bone mineral density measurement in 1 year
4) Prophylactic fixation of the contralateral hip

This patient has a new fracture. Because the fracture occurred following minor trauma, the physician should assume that this patient has an insufficiency fracture related to her osteoporosis.

Patients who sustain an osteoporotic hip fracture should be treated with antiresorptive therapy to lower the risk of a subsequent hip or vertebral fracture. A recent randomized trial showed the following:

A large prospective, randomized study showed a reduction in vertebral and nonvertebral fractures when patients were treated with intravenous (IV) zoledronic acid within 90 days of a hip fracture, followed up with annual treatment.

Important points to remember about this study:

- Study: Zoledronic acid (5 mg, IV) within 90 days of hip fracture and then annually (1,000 patients in each group)
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  Â Â o Â Â Vertebral: 1.7% vs 3.8% (*P* = .02)
  Â Â o Â Â Nonvertebral: 7.6% vs 10.7% (*P* = .03)
  Â Â o Â Â Hip: 2.0% vs 3.5% (relative risk 30%, not significant)
  Â Â o Â Â Divergence of fracture-free survival at 12 months

Correct Answer: Antiresorptive therapy

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982. (3768) Q2-7550:

Which of the following biomaterials is considered inert:

1) Porous tantalum
3) Biodegradable polymeric scaffolds
2) Autologous chondrocytes
5) Cobalt-chromium alloys
4) Calcium sulfate pellets

Biocompatibility refers to materials that can be implanted into the body without causing major adverse reactions. Some materials, such as cobalt chromium alloys, are essentially inert; these materials cause no reaction from the body.

Other materials might be biocompatible, but they are not inert:

- Porous tantalum is a metal material that grows into bone.
- Autologous chondrocytes are grown in vitro and then used as filler for cartilage defects.
- Biodegradable polymeric scaffolds are resorbed and new tissues are laid down upon them.
- Calcium sulfate pellets are quickly resorbed over a 4- to 6-week period and new bone formation occurs either completely or incompletely.

Correct Answer: Cobalt-chromium alloys

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983. (3769) Q2-7551:

Which of the following materials is biocompatible in bulk form but may cause severe soft tissue reactions and damage in particulate form:

1) Freeze-dried allograft
3) Polymethylmethacrylate
2) Fresh-frozen allograft
5) Cobalt-chromium alloy
4) Ultra-high molecular weight polyethylene

Ultra-high molecular weight polyethylene is inert in bulk form but may cause severe bone loss when found in a particulate form. Wear debris that is generated at a polyethylene metal articulation is ingested by macrophages and an inflammatory response is generated. Bone resorption often results with aseptic loosening of the involved component.

Correct Answer: Ultra-high molecular weight polyethylene

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984. (3770) Q2-7552:

Which of the following describes galvanic corrosion:

1) Between the femoral head and tapered neck
3) Delamination of high-density polyethylene
2) Screw head and countersunk region of the acetabular component
5) Irradiation of high-density polyethylene in an ambient environment
4) At the interface between a plate and the screw heads

Galvanic corrosion is caused by an electrochemical potential that is created between two metals that are located in a conductive environment, such as body fluids.

Examples of galvanic corrosion include:

- Screw heads and a plate
- Femoral head screw and barrel of a dynamic hip screw
- Interlocking screws and an intramedullary nail

Galvanic corrosion can also occur within a metal if there are impurities (intergranular corrosion).

The other responses refer to:

- Fretting corrosion: Between the femoral head and tapered neck
- Crevice corrosion: Screw head and countersunk region of the acetabular component
- Oxidative degradation: Delamination of high-density polyethylene
- Oxidative degradation: Irradiation of high-density polytheylene in an ambient environment

Correct Answer: At the interface between a plate and the screw heads

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985. (3771) Q2-7553:

Which of the following describes fretting corrosion:

1) Impurities within a metal implant
3) At sites of electrochemical gradients
2) At a surface defect of an implant
5) Free-radical generation during sterilization
4) Relative micromotion under load

Fretting corrosion occurs when micromotion exists between two metals in contact. One of the most common examples of fretting corrosion is micromotion between a modular femoral head and the tapered neck junction. Modular components, such as the S-ROM system (DePuy Orthopaedics Inc., Warsaw, Ind), are subject to fretting corrosion at each of the junctions.

Techniques to minimize fretting corrosion include:

- Making sure the head-neck junctions are dry and clean
- Eliminating micromotion but having an exact fit (ie, not mixing manufacturers)

The other responses refer to:

- Galvanic corrosion: Impurities within a metal implant
- Crevice corrosion: At a surface defect of an implant
- Galvanic corrosion: At sites of electrochemical gradients
- Oxidative degradation: Irradiation of high-density polyethylene in an ambient environment

Correct Answer: Relative micromotion under load

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986. (3772) Q2-7554:

Which of the following describes crevice corrosion:

1) Impurities within an implant
3) Relative micromotion under load
2) At sites of an electrochemical potential
5) Differences in oxygen tension causing pH and electrolyte changes
4) Free-radical generation during air sterilization

Crevice corrosion occurs at the sites of a surface defect in a metal implant. At these defects, changes in pH and electrolyte concentrations cause corrosion.

Common examples of crevice corrosion include:

- At the interface between an uncemented acetabular component and the cancellous screws (at the contact point where the head of the screw is countersunk into the acetabular shell)
- At the interface between a screw head and the plate at the point where the screw head contacts the plate

The other responses refer to:

- Galvanic corrosion: Impurities within a metal implant
- Galvanic corrosion: At sites of electrochemical gradients
- Fretting corrosion: Relative micromotion under load
- Oxidative degradation: Free-radical generation during air sterilization

Correct Answer: Differences in oxygen tension causing pH and electrolyte changes

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987. (3773) Q2-7555:

Which of the following has led to oxidative degradation of ultra-high molecular weight polyethylene (UHMWPE):

1) Ram extrusion
3) Sterilization in an ambient environment
2) Compression molding
5) Sterilization with ethylene oxide
4) Direct molding

One of the most important examples of corrosion is the breakdown of ultra-high density polyethylene. Wear particles result in osteolysis and bone loss. When UHMWPE is sterilized in air, free radicals are generated and lead to oxidative degradation of the UHMWPE.

The other responses refer to:

- Ram extrusion: Manufacturing method for UHMWPE
- Compression molding: Manufacturing method for UHMWPE
- Direct molding: Manufacturing method for UHMWPE
- Sterilization with ethylene oxide: Alternative

Correct Answer: Sterilization in an ambient environment

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988. (3779) Q2-7561:

Which of the following statements concerning stress fractures is false:

1) Track teams have the highest incidence of stress fractures.
3) Stress fractures occur in normal bone subjected to abnormal stresses.
2) In military recruits, rates of stress fractures are gender dependent.
5) Stress fractures occur in normal bone subjected to normal stresses.
4) Stress fractures occur in sites of bone resorption due to continued loading.

The following are features of stress fractures:

A. Stress fractures most often occur from changes in an athleteâs training program.
    1. Increases in intensity
    2. Increases in duration

B. In military recruits, the rates are gender dependent.
    1. Men â 4%
    2. Women â 7%

C. Stress fractures occur in normal bone subjected to abnormal stresses.

D. Stress fractures occur in sites of bone resorption subjected to continued loading.

E. Important to know is the definition of insufficiency fractures â fractures in abnormal bone from normal stresses.

Correct Answer: Stress fractures occur in normal bone subjected to normal stresses.

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989. (3780) Q2-7562:

Which of the following is a significant risk factor for a stress fracture:

1) Testosterone levels in men
3) Training surfaces
2) Age
5) Low calcium intake
4) Menstrual irregularity

There are a number of risk factors for stress factors:

A. Menstrual irregularity in women is perhaps the most significant risk factor.
    1. Remember the terrible triad in female patients:
        a. Menstrual irregularity
        b. Eating disorders
        c. Low bone mass

B. Increase in frequency and intensity of athletic training or activity

C. Changes in athletic training are noted in 80% of athletes surveyed who have stress fractures.

D. Decreased tibial width (smaller bone size)

E. Factors that have not been found to be statistically significant include:
    1. Testosterone levels in male athletes
    2. Age
        a. Location by age is significant, but not etiology
    3. Training surfaces
    4. Flexibility
    5. Low calcium intake

Correct Answer: Menstrual irregularity

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990. (3781) Q2-7563:

Which of the following is a significant risk factor for a stress fracture:

1) Flexibility
3) Increase in frequency and intensity of training
2) Training surfaces
5) Testosterone levels in athletes
4) Low calcium intake

There are a number of risk factors for stress fractures:

A. Menstrual irregularity in women is perhaps the most significant risk factor.
    1. Remember the terrible triad in female patients:
        a. Menstrual irregularity
        b. Eating disorders
        c. Low bone mass

B. Increase in frequency and intensity of athletic training or activity

C. Changes in athletic training are noted in 80% of athletes surveyed who have stress fractures.

D. Decreased tibial width (smaller bone size)

E. Factors that have not been found to be statistically significant include:
    1. Testosterone levels in male athletes
    2. Age
        a. Location by age is significant, but not etiology
    3. Training surfaces
    4. Flexibility
    5. Low calcium intake

Correct Answer: Increase in frequency and intensity of training

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991. (3782) Q2-7564:

Which of the following statements regarding plain radiographic findings of stress fractures is false:

1) Plain radiographs have a low false-negative rate.
3) Only 20% of bone scan positive foci correlate with positive radiographic findings.
2) Periosteal bone formation is a hallmark finding.
5) he âgray cortexâ may occur secondary to cortical resorption.
4) Positive radiographic findings include horizontal or linear patterns of sclerosis.

Plain radiographs have a high false-negative rate especially early in the clinical course of stress fracture.

- Periosteal new bone formation is a hallmark finding.
- Only 20% of bone scan positive foci correlate with positive radiographs.
- Positive radiographic findings include horizontal or linear patterns of sclerosis.
- The âgray cortexâ may occur from increased osteoclastic resorption on the cortex.

Correct Answer: Plain radiographs have a low false-negative rate.

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992. (3783) Q2-7565:

A patient has an early stage stress fracture (grade 1) on a technetium bone scan. The magnetic resonance image findings most likely to correlate with the bone scan are:

1) Periosteal high signal on T2; normal marrow signal on T1- and T2-weighted images
3) Periosteal high signal on T2; increased signal on T1; and normal signal on T2-weighted images
2) Normal periosteal signal; normal marrow signal on T1- and T2-weighted images
5) Normal periosteal signal; decreased marrow signal on T1; and high signal on T2-weighted images
4) Periosteal high signal on T2; normal signal on T1; and high signal on T2-weighted images

In 1995, Fredrickson and colleagues classified stress fractures into four grades based upon bone scans:

Grade 1Â Â Â Â Â Small ill-defined cortical area of mildly increased activity
Grade 2Â Â Â Â Â Well-defined cortical area of moderately increased corticalÂ activity
Grade 3Â Â Â Â Â Wide, cortical-medullary area of increased activity
Grade 4Â Â Â Â Â Transcortical area of intensely increased activity

In an early stress fracture (grade 1 bone scan criteria), a periosteal high signal on T2-weighted images and a normal marrow signal are present.Correct Answer: Periosteal high signal on T2; normal marrow signal on T1- and T2-weighted images

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993. (3784) Q2-7566:

A patient with stress fracture has a transcortical area of intense uptake on the technetium bone scan. Which of the following findings would most likely be present on the magnetic resonance imaging (MRI) scan:

1) Normal periosteal signal; normal marrow signal on T1; high marrow signal on T2
3) Normal periosteal signal on T2; low marrow signal on T1; high marrow signal on T2
2) Normal periosteal signal; low marrow signal on T1; high marrow signal on T2
5) High periosteal signal on T2; low marrow signal on T1; normal marrow signal on T2
4) High periosteal signal on T2; low marrow signal on T1; high marrow signal on T2

In 1995, Fredrickson and colleagues classified stress fractures into four grades based upon bone scans:

Grade 1Â Â Â Â Â Small ill-defined cortical area of mildly increased activity
Grade 2Â Â Â Â Â Well-defined cortical area of moderately increased cortical
Â activity
Grade 3Â Â Â Â Â Wide, cortical-medullary area of increased activity
Grade 4Â Â Â Â Â Transcortical area of intensely increased activity

In a grade 4 stress fracture, the corresponding MRI will show:

- High periosteal signal on T2-weighted images
- Low signal on T1-weighted images, often with a liner low signal line representing the fracture line
- High signal on T2-weighted images, often with a liner low signal line representing the fracture line

Correct Answer: High periosteal signal on T2; low marrow signal on T1; high marrow signal on T2

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994. (3785) Q2-7567:

A patient has a defined area of moderately increased activity in the femoral shaft consistent with a stress fracture (grade 2 by bone scan criteria). Which of the following is the corresponding finding on the magnetic resonance imaging scan:

1) Normal periosteal signal; normal marrow T1 signal; high marrow T2 signal
3) High periosteal signal; high marrow T1 signal; normal marrow T2 signal
2) Normal periosteal signal; high marrow T1 signal; high marrow T2 signal
5) High periosteal signal; normal marrow T1 signal; high marrow T2 signal
4) High periosteal signal; normal marrow T1 signal; high marrow T2 signal

In 1995, Fredrickson and colleagues classified stress fractures into four grades based upon bone scans:

Grade 1Â Â Â Â Â Small ill-defined cortical area of mildly increased activity
Grade 2Â Â Â Â Â Well-defined cortical area of moderately increased cortical
Â activity
Grade 3Â Â Â Â Â Wide, cortical-medullary area of increased activity
Grade 4Â Â Â Â Â Transcortical area of intensely increased activity

Correct Answer: High periosteal signal; normal marrow T1 signal; high marrow T2 signal

995. (3786) Q2-7568:

Which of the following treatment methods is used for the majority of patients with a stress fracture:

1) Rest and protected weight-bearing
3) Plate fixation with bone grafting
2) Rest and electrical stimulation
5) Intramedullary rod fixation
4) Plate fixation without bone grafting

The majority of stress fractures are treated with rest and protected weight-bearing. When the patient rests, strain on the affected bone is reduced and formation exceeds resorption, leading to bone healing.

Electrical stimulation and ultrasound have not been shown to increase the rate of healing. For most stress fractures, surgery is not necessary.

Correct Answer: Rest and protected weight-bearing

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996. (3787) Q2-7569:

Which of the following stress fractures most often requires internal fixation:

1) Second metatarsal
3) Sacrum
2) Femoral shaft
5) Tension-sided femoral neck
4) Compression-sided femoral neck

The majority of stress fractures are treated with rest and protected weight-bearing. When the patient rests, strain on the affected bone is reduced and formation exceeds resorption, leading to bone healing.

A tension-sided femoral neck stress fracture is most at risk for progression to a complete fracture and displacement.

Correct Answer: Tension-sided femoral neck

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997. (3788) Q2-7570:

Which of the following stress fractures is the most prone to nonunion and require surgical intervention:

1) Proximal posteromedial compression
3) Anterior tibial cortex tension
2) Distal posteromedial compression
5) Medial malleolus
4) Femoral shaft compression

The majority of stress fractures are treated with rest and protected weight-bearing. When the patient rests, strain on the affected bone is reduced and formation exceeds resorption, leading to bone healing.

An anterior tibial tension stress fracture is most prone to not healing. This fracture typically occurs in the anterior cortex and appears as a horizontal lucency â the dreaded black line.

Many patients with this fracture will not heal nonoperatively and will require intramedullary rod fixation.

Correct Answer: Anterior tibial cortex tension

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998. (3789) Q2-7571:

Which of the following activities predisposes a patient to an anterior tibial cortex stress fracture:

1) Long-distance running
3) Military recruits following long marches
2) Repetitive jumping or leaping
5) Playing tennis
4) Gymnastics

Repetitive stresses from jumping or leaping is a risk factor for anterior tibial cortex stress fractures.

Correct Answer: Repetitive jumping or leaping

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999. (3794) Q2-7577:

Which of the following properties is false concerning articular cartilage:

1) Avascular (no blood vessels)
3) Alymphatic (no lymphatic vessels)
2) Aneural (no nerve fibers)
5) Self-renewing (maintenance and restoration of extracellular matrix)
4) Moderate friction on cartilage-on-cartilage motion

Important properties of articular cartilage include:

- Avascular (no blood vessels)
- Aneural (no nerve fibers)
- Alymphatic (no lymphatic vessels)
- Very low friction on cartilage on cartilage motion
- Self-renewing (maintenance and restoration of extracellular matrix)
- With aging, loss of ability to maintain the extracellular matrix

Correct Answer: Moderate friction on cartilage-on-cartilage motion

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1000. (3795) Q2-7578:

Which of the following statements is true concerning chondrocytes:

1) Chondrocytes represent 10% to 15% of the cartilage volume.
3) Chondrocytes form an intricate network of cell-to-cell contact within the extracellular matrix.
2) Chondrocytes lack an endoplasmic reticulum and Golgi apparatus.
5) Chondrocytes respond to growth factors and anabolic stimuli.
4) Chondrocytes do not decrease their synthetic ability with aging.

There are several important points to remember about chondrocytes:

- By cartilage volume, the cells only represent about 1%.
- Chondrocytes are synthetic machines producing the extracellular matrix.
    - Intracellular organelles
        - Endoplasmic reticulum
        - Golgi apparatus
- Chondrocytes do not have cell-to-cell contact in the extracellular matrix.
- With aging, chondrocytes lose their synthetic abilities.
- Chondrocytes respond to a number of stimuli:
    - Increase matrix production after sensing degradation of the matrix
    - Sense loads and increase matrix production
    - Respond to growth factors and anabolic stimuli

Correct Answer: Chondrocytes respond to growth factors and anabolic stimuli.

1001. (3796) Q2-7579:

Which of the following is the proper sequence (or order) of the classes of macromolecules in articular cartilage in regard to the percentage of dry weight of the components (highest to lowest):

1) Collagen, proteoglycans, noncollagenous proteins/glycoproteins
3) Proteoglycans, noncollagenous proteins/glycoproteins, collagen
2) Proteoglycans, collagen, noncollagenous proteins/glycoproteins
5) Noncollagenous proteins/glycoproteins, collagen, proteoglycans
4) Collagen, noncollagenous proteins/glycoproteins, proteoglycans

Articular cartilage has three principal classes of macromolecules:

- Collagen – 60%
- Proteoglycans – 25% to 35%
- Noncollagenous proteins/glycoproteins – 15% to 20%

Correct Answer: Collagen, proteoglycans, noncollagenous proteins/glycoproteins

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1002. (3797) Q2-7580:

Which of the following articular cartilage collagens form cross-banded fibrils:

1) Types VI and X
3) Types II, IX, and XI
2) Types I, III, and V
5) Types II, VI, IX, X, and XI
4) Types II, VI, and X

The three articular cartilage collagens that form cross bands are types II, IX, and XI.

Of particular note:

- Type XI binds to type II.
- Type IX binds to the cross-banded fibrils in the superficial layer.
- Type VI attaches to the matrix around the chondrocytes.
- Type X is near the calcified layer and is probably involved in mineralization of the calcified layer.

Correct Answer: Types II, IX, and XI

1003. (3798) Q2-7581:

Which of the following molecules binds with type II collagen and may aid in the stabilization of the type II collagen network in articular cartilage:

1) Transforming growth factor beta
3) Biglycan
2) Decorin and fibromodulin
5) Cartilage oligomeric protein (COMP)
4) Anchorin CII

Decorin and fibromodulin bind to type II collagen and likely stabilize the type II collagen network.

The other responses refer to:

- Biglycan: Binds with type VI collagen
- Anchorin CII: Helps attach chondrocytes to the collagen fibrils
- COMP: Binds to chondrocytes

Correct Answer: Decorin and fibromodulin

1004. (3799) Q2-7582:

A high collagen concentration and a low proteoglycan concentration is found in which of the following zones of articular cartilage:

1) Superficial zone
3) Middle (radial or deep) zone
2) Transitional zone
5) Tidemark zone
4) Calcified cartilage zone

The superficial zone has a number of important characteristics:

- Thinnest articular cartilage layer
- Two layers:
  - Most superficial – fine collagen fibrils (lamina splendens)
  - Deep layer – flattened fibroblast-like chondrocytes (parallel to joint surface)
- Forms a cartilage skin
- Important chemical properties:
  - High collagen and low proteoglycan concentration
  - Fibronectin and water concentrations are highest in this zone
- Great tensile stiffness and strength
- Seals off the cartilage from the immune system

Correct Answer: Superficial zone

1005. (3800) Q2-7583:

A high concentration of fibronectin and water is found in which of the following articular cartilage zones:

1) Superficial zone
3) Middle (radial or deep) zone
2) Transitional zone
5) Tidemark zone
4) Calcified cartilage zone

The superficial zone has a number of important characteristics:

- Thinnest articular cartilage layer
- Two layers:
  - Most superficial – fine collagen fibrils (lamina splendens)
  - Deep layer – flattened fibroblast-like chondrocytes (parallel to joint surface)
- Forms a cartilage skin
- Important chemical properties:
  - High collagen and low proteoglycan concentration
  - Fibronectin and water concentrations are highest in this zone
- Great tensile stiffness and strength
- Seals off the cartilage from the immune system

Correct Answer: Superficial zone

1006. (3801) Q2-7584:

Which of the following zones of the articular cartilage most likely seals the cartilage off from the immune system:

1) Superficial zone
3) Middle (radial or deep) zone
2) Transitional zone
5) Tidemark zone
4) Calcified zone

The superficial zone has a number of important characteristics:

- Thinnest articular cartilage layer
- Two layers:
  - Most superficial – fine collagen fibrils (lamina splendens)
  - Deep layer – flattened fibroblast-like chondrocytes (parallel to joint surface)
- Forms a cartilage skin
- Important chemical properties:
  - High collagen and low proteoglycan concentration
  - Fibronectin and water concentrations are highest in this zone
- Great tensile stiffness and strength
- Seals off the cartilage from the immune system

Correct Answer: Superficial zone

1007. (3802) Q2-7585:

Which of the following statements is true concerning the transitional zone of articular cartilage:

1) Cells are ellipsoid shaped and parallel to the articular surface.
3) The chondrocytes have a high concentration of organelles such as rough endoplasmic reticulum and Golgi apparatus.
2) The extracellular matrix has a high water and a low proteoglycan content.
5) The collagen fibers are perpendicular to the surface and resist shear stresses.
4) The extracellular matrix has the largest diameter collagen fibers and the highest concentration of proteoglycans.

The transitional zone lies between the superficial and middle zones of the articular cartilage.

The following important points should be remembered:

- The chondrocytes have a high concentration of synthetic organelles such as rough endoplasmic reticulum and Golgi apparatus.
- The collagen fibers are larger than in the superficial zone.
- The proteoglycan concentration is higher than the superficial zone.

Correct Answer: The chondrocytes have a high concentration of organelles such as rough endoplasmic reticulum and Golgi apparatus.

1008. (3803) Q2-7586:

The chondrocytes in which of the following articular cartilage zones have the lowest metabolic activity:

1) Superficial zone
3) Middle (radial or deep) zone
2) Transitional zone
5) Tidemark zone
4) Calcified cartilage zone

The chondrocytes in the calcified cartilage zone show the least metabolic activity.

In contrast, the chondrocytes of the other areas are very active:

- Superficial zone
  - Fine collagen fibrils (lamina splendens)
  - High collagen and low proteoglycan concentration
  - Fibronectin and water concentrations are highest in this zone
- Transitional zone
  - The chondrocytes have a high concentration of synthetic organelles such as rough endoplasmic reticulum and Golgi apparatus.
  - The collagen fibers are larger than in the superficial zone.
  - The proteoglycan concentration is higher than the superficial zone.
- Middle (radial or deep) zone
  - Largest diameter collagen fibrils
  - Highest proteoglycan content

Correct Answer: Calcified cartilage zone

1009. (3804) Q2-7587:

Which of the following molecules causes the expression of matrix metalloproteinases that can degrade the articular cartilage extracellular matrix:

1) Insulin-dependent growth factor I
3) Interleukin I
2) Transforming growth factor beta
5) Bone morphogenetic protein 7
4) Bone morphogenetic protein 2

Interleukin I has the potential to increase expression of matrix metalloproteinases that can dissolve the extracellular matrix.

The other responses are anabolic factors:

- Insulin-dependent growth factor I
- Transforming growth factor beta
- Bone morphogenetic protein 2
- Bone morphogenetic protein 7

Correct Answer: Interleukin I

1010. (3805) Q2-7588:

Which of the following resist tensile and shear deformation forces in articular cartilage:

1) Biglycan
3) Glycosaminoglycans
2) Type II collagen fibers
5) Tidemark
4) Anchorin II

Type II collagen fibers resist tensile and shear deformation forces in the articular cartilage.

In contrast, the glycosaminoglycan aggregates resist articular cartilage compression and fluid flow.

Correct Answer: Type II collagen fibers

1011. (3806) Q2-7589:

Which of the following resist articular cartilage compression and fluid flow:

1) Biglycan
3) Glycosaminoglycan aggregates
2) Type II collagen fibers
5) Tidemark
4) Anchorin II

Type II collagen fibers resist tensile and shear deformation forces in the articular cartilage.

In contrast, the glycosaminoglycan aggregates resist articular cartilage compression and fluid flow.

Correct Answer: Glycosaminoglycan aggregates

1012. (3807) Q2-7590:

Which of the following stimulates aggrecan core protein and glycosaminoglycan synthesis:

1) Static compression within the physiologic range
3) Cyclic intermittent hydrostatic pressure and compressive strain
2) Chronic compressive loads outside the physiologic range
5) Tumor necrosis factor
4) Interleukin I and matrix metalloproteinases

Cyclic compressive loads have the ability to stimulate matrix synthesis â aggrecan core protein and the glycosaminoglycans.

The other responses are catabolic toward the cartilage â break the cartilage down:

- Tumor necrosis factor
- Interleukin I
- Matrix metalloproteinases
- Chronic compressive loads outside the physiologic range
- Static compression (eg, putting a patient in a cast)

Correct Answer: Cyclic intermittent hydrostatic pressure and compressive strain

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1013. (3808) Q2-7591:

Which of the following are characteristic of osteoarthritis:

1) Synovial proliferation, cysts/erosions on both sides of the joint
3) Asymmetric joint space loss, subchondral sclerosis and cysts, osteophyte formation
2) Synovial proliferation, periarticular osteopenia, symmetric joint space loss
5) Periarticular erosions, preservation of the articular surface
4) Subluxation, bone fragmentation, dissolution of the articular surfaces

The characteristic findings in osteoarthritis are:

- Asymmetric loss of the joint space
- Subchondral sclerosis and cysts
- Osteophyte formation

As the cartilage degenerates, progressive bone remodeling occurs.

The other responses refer to other synovial proliferative disorders:

- Pigmented villonodular synovitis: Synovial proliferation, cysts/erosions on both sides of the joint
- Rheumatoid arthritis: Synovial proliferation with lymphocytic infiltration, periarticular osteopenia, symmetric joint space loss
- Charcot neuropathy: Subluxation, bone fragmentation, dissolution of the articular surfaces
- Gout: Periarticular erosions, soft tissue masses, preservation of the articular surfaces

Correct Answer: Asymmetric joint space loss, subchondral sclerosis and cysts, osteophyte formation

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1014. (3809) Q2-7592:

Which of the following chemical changes occur in the first phase (earliest) of osteoarthritis:

1) Constant collagen, decreased proteoglycan, constant water
3) Decreased collagen, decreased proteoglycan, decreased water
2) Constant collagen, decreased proteoglycan, increased water
5) Constant collagen, constant proteoglycan, increased water
4) Decreased collagen, decreased proteoglycan, increased water

The cause of osteoarthritis is unknown. From a chemical standpoint, one of the earliest findings is a decrease in the proteoglycan and an increase in the water content. One should remember:

- Constant type II collagen content
- Decreased proteoglycan concentration and decreased chain length
- Increased water content

The decreased proteoglycan content results in increased permeability of the cartilage. A reduction of the stiffness makes the articular cartilage less able to bear loads.

Correct Answer: Constant collagen, decreased proteoglycan, increased water

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1015. (3810) Q2-7593:

Which of the following is characteristic of the second stage of osteoarthritis:

1) Reduction in proteoglycan concentration
3) Formation of type I collagen
2) Decrease in water content
5) Reduction in interleukin I levels
4) Chondrocyte proliferation

The cause of osteoarthritis is unknown. From a chemical standpoint, one of the earliest findings is a decrease in the proteoglycan and an increase in the water content. One should remember:

- Constant type II collagen content
- Decreased proteoglycan concentration and decreased chain length
- Increased water content

In the second stage, there is a cellular response â chondrocyte proliferation. Clusters of chondrocytes producing new matrix are visible.

In this stage, there is nitric oxide and interleukin I production. These are catabolic factors that increase matrix metalloproteinase activity. Degradative enzymes break down types IX and XI collagen, which may compromise the stability of the type II collagen framework.

Correct Answer: Chondrocyte proliferation

1016. (3811) Q2-7594:

Which of the following is characteristic of the second stage of osteoarthritis:

1) Increased interleukin I levels
3) Formation of type I collagen
2) Decrease in water content
5) Reduced chondrocyte proliferation and synthesis
4) Increased proteoglycan concentration

The cause of osteoarthritis is unknown. From a chemical standpoint, one of the earliest findings is a decrease in the proteoglycan and an increase in the water content. One should remember:

- Constant type II collagen content
- Decreased proteoglycan concentration and decreased chain length
- Increased water content

In the second stage, there is a cellular response â chondrocyte proliferation. Clusters of chondrocytes producing new matrix are visible.

In this stage, there is nitric oxide and interleukin I production. These are catabolic factors that increase matrix metalloproteinase activity. Degradative enzymes break down types IX and XI collagen, which may compromise the stability of the type II collagen framework.

Correct Answer: Increased interleukin I levels

1017. (3812) Q2-7595:

Which of the following is characteristic of the second stage of osteoarthritis:

1) Decrease in water content
3) Increased nitric oxide production
2) Decreased proteoglycan synthesis
5) Production of type I collagen
4) Reduced matrix metalloproteinase production

The cause of osteoarthritis is unknown. From a chemical standpoint, one of the earliest findings is a decrease in the proteoglycan and an increase in the water content. One should remember:

- Constant type II collagen content
- Decreased proteoglycan concentration and decreased chain length
- Increased water content

In the second stage, there is a cellular response â chondrocyte proliferation. Clusters of chondrocytes producing new matrix are visible.

In this stage, there is nitric oxide and interleukin I production. These are catabolic factors that increase matrix metalloproteinase activity. Degradative enzymes break down types IX and XI collagen, which may compromise the stability of the type II collagen framework.

Correct Answer: Increased nitric oxide production

1018. (3813) Q2-7596:

Which of the following is characteristic of the third and final stage of osteoarthritis:

1) Decreased water content
3) Reduced interleukin I levels
2) Increased proteoglycan content
5) Reduced chondrocyte proliferation and function
4) Reduced nitric oxide levels

In the last stage of osteoarthritis, there is reduced chondrocyte proliferation and function, which may be secondary to reduced ability to respond to anabolic factors (down regulation). There may be accumulation of molecules that bind to the anabolic factors (and keep the factors from the chondrocytes) such as decorin and insulin-dependent growth factor binding protein.

Correct Answer: Reduced chondrocyte proliferation and function

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1019. (300) Q3-415:

Three years ago, a patient underwent successful resection of a third web space neuroma. She now presents with identical symptoms in the same location. She requests surgery because all attempts at conservative care have failed. Recommended treatment includes:

1) Phenol injection
3) Deep transverse metatarsal ligament resection
2) Electrical ablation of the nerve
5) Tarsal tunnel release
4) Resection of a stump neuroma

The recurrence rate of a previously resected neuroma is approximately 15%. The deep transverse metatarsal ligament is involved in the pathogenesis of a primary, but not a recurrent, neuroma. None of the present symptoms suggests tarsal tunnel syndrome, although this may exist concurrently with a neuroma. Phenol has ablative neural properties, but it cannot be injected due to the local effect on tissue necrosis.Correct Answer: Resection of a stump neuroma

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1020. (301) Q3-416:

A 72-year-old woman presents for treatment of a painful hallux valgus deformity. On examination of the foot, crepitus is present to range of motion of the hallux. Pain upon compression of the joint is also present. The hallux valgus angle is 45Â° and the intermetatarsal angle is 20Â°. The recommended surgical procedure is:

1) Arthrodesis of the hallux metatarsalphalangeal (MP) joint
3) Distal metatarsal osteotomy and distal soft tissue release
2) Proximal first metatarsal osteotomy and distal soft tissue release
5) Arthrodesis first MP joint and distal soft tissue release (Lapidus procedure)
4) Resection arthroplasty MP joint (Keller procedure)

In the presence of metatarsalphalangeal joint arthritis, either resection arthroplasty or arthrodesis is recommended. However, with this degree of intermetatarsal deformity, a resection arthroplasty may lead to a high recurrence rate of hallux valgus deformity.Correct Answer: Arthrodesis of the hallux metatarsalphalangeal (MP) joint

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1021. (302) Q3-417:

Resection of the tibial sesamoid may result in which deformity of the hallux:

1) Hallux extensus
3) Hallux varus
2) Hallux valgus
5) Supination deformity
4) Cock-up deformity

The abductor hallucis muscle attaches to the tibial sesamoid and resection without repair of the abductor and medial capsule may lead to hallux valgus. Hallux varus may occur after resection of the fibular sesamoid, and a cock-up extension hallux deformity occurs after resection of both sesamoids or with a rupture of the volar plate.Correct Answer: Hallux valgus

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1022. (303) Q3-418:

Arthrodesis of the ankle in a 34-year-old woman should be performed with the ankle positioned in:

1) 10Â° plantarflexion, neutral rotation
3) Neutral dorsiflexion, 5Â° valgus
2) 10Â° dorsiflexion, 5Â° external rotation
5) 10Â° plantarflexion, 5Â° internal rotation
4) 10Â° plantarflexion, 15Â° external rotation

Although the woman may wish to wear shoes of varying height, there is sufficient plantarflexion occurring through the transverse tarsal joint to permit the wearing of high-heel shoes. Any plantarflexion of the fusion will cause arthritis of the transverse tarsal joint, particularly the talonavicular joint. Dorsiflexion of an ankle arthrodesis is associated with a calcaneus position and heel pain. The ankle should be fused in a similar position for both male and female patients.Correct Answer: Neutral dorsiflexion, 5Â° valgus

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1023. (304) Q3-419:

A 27-year-old male athlete presents with a 2-month history of pain along the posteromedial ankle. Swelling is present posteriomedially. The pain is exacerbated with resisted plantarflexion and inversion of the foot. This condition is likely to be associated with:

1) Rheumatoid arthritis
3) Seronegative arthritis
2) Repetitive trauma
5) Stress fracture
4) Gout

The presence of posterior tibial tendonitis in a young individual should raise the concern for seronegative arthritis. Although a stress fracture of the medial malleolus may be present, pain is not exacerbated with resisted inversion.Correct Answer: Seronegative arthritis

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1024. (305) Q3-420:

A 23-year-old collegiate athlete presents for evaluation of recurrent ankle pain associated with ankle sprains. Upon examination, pain is present along the lateral ankle, an anterior drawer test is negative, and marked instability is apparent with inversion stress of the ankle. Stress radiographs are normal. The most likely cause of the patientâs symptoms is:

1) Stress fracture of the navicular bone
3) Recurrent dislocation of peroneal tendons
2) Peroneus brevis tear
5) Subtalar instability
4) Osteochondral lesion of the talus

Subtalar instability is not common, although a component of instability may be present in conjunction with ankle instability. If symptoms are suggestive of ankle instability but cannot be verified upon clinical or radiographic examination, then subtalar instability is likely to be present. The clinical diagnosis of subtalar instability is difficult.Correct Answer: Subtalar instability

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1025. (306) Q3-421:

A 46-year-old nurse presents for treatment of pain in the heel. The pain has been present for 6 months and increases upon rising from bed and after sedentary periods. The pain is focal and reproduced with pressure over the proximal medial heel. The initial treatment most likely to be associated with relief of symptoms is:

1) Semi-rigid orthotic support
3) Achilles tendon stretching exercises
2) Stiff sole shoe with heel wedge
5) Physical therapy modalities
4) Cortisone injection

With the exception of physical therapy and a rigid orthotic support, most of the treatment alternatives would be helpful in the initial treatment of plantar fasciitis. Achilles stretching combined with a soft, gel-type heel cushion is consistently the most successful modality.Correct Answer: Achilles tendon stretching exercises

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1026. (307) Q3-422:

A 72-year-old man presents for evaluation and treatment of pain and limited motion in his arthritic ankle and subtalar joint. The foot is plantigrade with respect to the leg. Radiographs demonstrate ankle arthritis, an absent joint space, no malalignment of the tibiotalar joint, and a normal subtalar joint. The most reliable surgical procedure consistent with maintaining increased activity and patient function is:

1) Total ankle replacement
3) Supramalleolar tibial closing wedge osteotomy
2) Supramalleolar tibial opening wedge osteotomy
5) Ankle arthroscopy
4) Ankle arthrodesis

Ankle replacement is a treatment alternative that is widely recommended today, although it is still not as reliable as an ankle arthrodesis in terms of predictability and absence of complications. One must consider the option of arthrodesis and replacement carefully with each patient.Correct Answer: Ankle arthrodesis

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1027. (308) Q3-423:

A 37-year-old construction worker presents for evaluation and treatment of a painful stiff foot. He has noticed the stiffness for approximately 12 years, and particularly feels the stiffness when he is working on uneven ground surfaces. Upon clinical and radiographic examination, he is noted to have a calcaneonavicular coalition without any peritalar arthritis. Your recommended treatment is:

1) Triple arthrodesis
3) Resection of the coalition
2) Subtalar arthrodesis
5) Calcaneocuboid and talonavicular arthrodesis
4) Calcaneal osteotomy

Although arthrodesis has proved reliable with respect to managing tarsal coalition in the adult, resection of a calcaneonavicular coalition should be performed whenever possible. This procedure is preferable to a triple arthrodesis. A subtalar arthrodesis would be applicable as treatment for a middle facet coalition in the adult.Correct Answer: Resection of the coalition

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1028. (309) Q3-424:

A 28-year-old male runner presents for treatment of a painful lesion under the first metatarsal head (located more toward the medial aspect of the metatarsophalangeal joint). The lesion is associated with painful callosity to palpation, normal hallux function, and a normal position of the first metatarsal. Attempts to relieve the pressure with orthoses and shoe modifications have not been successful. The ideal treatment is:

1) Arthrodesis of the first metatarsophalangeal joint
3) Resection of the tibial sesamoid
2) Dorsal wedge osteotomy of the distal first metatarsal
5) Proximal first metatarsal osteotomy
4) Plantar shaving of the tibial sesamoid

Planing or shaving of the sesamoid is a reliable procedure for treatment of a specific focal keratosis beneath the tibial sesamoid. Resection of the tibial sesamoid is a reasonable alternative, although it should be used only for pathology of the sesamoid itself. In this individual, the position of the first metatarsal is normal. Since no plantarflexion is present, an osteotomy is not indicated.Correct Answer: Plantar shaving of the tibial sesamoid

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1029. (310) Q3-425:

A 29-year-old football player twisted his foot 1 year ago, and he recalls pain and swelling of the midfoot at the time of the injury. No definitive treatment was provided at that time. Although he returned to athletic activity, he has experienced constant pain and occasional swelling. The pain is present upon passive pronation and abduction of the midfoot, and radiographs demonstrate that there is a 2.5-mm gap between the base of the first and second metatarsal and medial and middle cuneiform. Initial management should include:

1) Medial to middle column tarsometatarsal arthrodesis
3) Delayed open reduction and internal fixation
2) Cortisone injection to the midfoot
5) A rigid orthotic support and a stiff-soled shoe
4) Physical therapy modalities aimed at mobilization of the midfoot

The patientâs history and clinical findings indicate an injury to the tarsometatarsal joint complex, specifically between the middle and the medial columns. Although surgery may become necessary, initial treatment should consist of support. Physical therapy will worsen foot pain and injection is not indicated.Correct Answer: A rigid orthotic support and a stiff-soled shoe

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1030. (311) Q3-426:

A 44-year-old man has a 2-year history of pain in his hallux. The pain is accompanied by limited range of motion, pain on passive dorsiflexion of the hallux, and difficulty with athletic activities. Radiographs demonstrate that the plantar two-thirds of the joint is normal, with osteophytes of the dorsal surface of the joint. He has been unsuccessful with shoe wear modifications, and he requests surgery. The ideal procedure for him would be:

1) Resection arthroplasty
3) Osteotomy of the first metatarsal
2) Implant arthroplasty
5) Arthrodesis of the metatarsophalangeal joint
4) Cheilectomy of the hallux

Preservation of the joint and maintaining range of motion are important to any active individual. Any procedure, such as resection or implant arthroplasty, is contraindicated in this age group. Arthritis has not progressed to the degree that arthrodesis is necessary.Correct Answer: Cheilectomy of the hallux

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1031. (312) Q3-427:

A 32-year-old woman with a history of diabetes presents with a 1-month history of painless swelling in the foot. The foot is swollen, warm, and erythema is present in the midfoot. She has no fever and her blood sugars are normal. Radiographs demonstrate the presence of fracture and dislocation of the tarsometatarsal joint. There are no new periosteal bone formations, and complete dorsal dislocation of the metatarsals on the cuneiforms is noted. The ideal treatment is:

1) Open reduction and internal fixation
3) Tarsometatarsal arthrodesis
2) Bedrest, limb elevation, and cast immobilization
5) Weight-bearing total contact cast
4) Midfoot biopsy followed by organism-specific antibiotics

If there is a contraindication to performing surgery, nonoperative methods of treatment for an acute Charcot neuroarthropathy may be acceptable. This patientâs midfoot is dislocated and is likely to result in a worsening deformity over time, with ulceration and infection possible. Open reduction with internal fixation has not proven sufficient in patients presenting with the symptoms indicated in the scenario. Arthrodesis is most likely to yield a satisfactory outcome.Correct Answer: Tarsometatarsal arthrodesis

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1032. (313) Q3-428:

A 54-year-old woman presents with a 1-year history of medial foot and ankle pain. She does not recall an episode of trauma, and she has had no change in her daily living activities. Her foot is changing shape; it is flatter than the opposite foot. On clinical examination she has a unilateral flatfoot deformity, an inability to perform a single heel rise, and weak inversion strength. The subtalar joint is flexible. Following an initial period of support of the foot, surgery is recommended. The ideal procedure is:

1) Subtalar arthrodesis
3) Repair torn spring ligament
2) Triple arthrodesis
5) Flexor digitorum longus transfer with calcaneal osteotomy
4) Posterior tibial tendon repair

This patient has a rupture of the posterior tibial tendon. Repair of the tendon will not work because there is a degenerative elongation of the tendon that will not heal. Because the foot is flexible, arthrodesis is not necessary. Flexor digitorum longus transfer with calcaneal osteotomy is a reliable procedure for treatment of Stage II posterior tibial tendon insufficiency.Correct Answer: Flexor digitorum longus transfer with calcaneal osteotomy

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1033. (314) Q3-429:

The anatomic structure responsible for the development of an interdigital neuroma is:

1) The intermetatarsal bursa
3) The deep transverse metatarsal ligament
2) The interosseous tendon
5) The bifurcation of the lateral plantar nerve
4) The third metatarsal head

The deep transverse metatarsal ligament passes between the undersurface of the metatarsal heads and connects the volar plate to the adjacent soft tissue structures. The common digital nerve becomes irritated under the sharp edge of the distal portion of the ligament, resulting in nerve swelling and formation of the neuroma.Correct Answer: The deep transverse metatarsal ligament

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1034. (315) Q3-430:

A 14-year-old boy with a painful flatfoot deformity presents for evaluation and treatment. He has had pain of the midfoot associated with thickening, callosity, and shoe wear. Shoe wear modifications, orthoses, and restriction of activity have not been successful. On examination, he has a very flexible flatfoot deformity. The hindfoot and midfoot are passively correctable, the subtalar and transverse tarsal joints are mobile, and callosity is present over the talar head. The recommended treatment is:

1) Arthrodesis of the subtalar joint
3) Lateral column lengthening osteotomy through the neck of the calcaneus
2) Triple arthrodesis
5) Resection of the symptomatic accessory navicular bone and advancement of the posterior tibial tendon
4) Medial displacement calcaneal osteotomy with flexor digitorum longus tendon transfer

It is unusual for an adolescent to require surgical correction of a flatfoot deformity, however, when the deformity is markedly symptomatic, surgery is a reasonable treatment option. Arthrodesis should not be considered as treatment of the flexible flatfoot in the adolescent. There is no indication of an accessory navicular bone being present. Lateral column lengthening (Evans Procedure) is a reliable procedure in this age group. The most common correction in kids with severe flexible pes planus is a lateral column lengthening. This is because most children, such as in this case, have severe forefoot abduction with significant talo-navicular uncoverage. (The description stated that the patient had a callus under the talar head, which means the talus is protruding beyond the navicular medially.) Medial slide calcaneal osteotomy would only correct the heel valgus, whereas a lateral column lengthening has the potential to correct both heel valgus and forefoot abduction.Correct Answer: Lateral column lengthening osteotomy through the neck of the calcaneus

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1035. (316) Q3-431:

A 23-year-old woman with juvenile rheumatoid arthritis presents for treatment of painful forefoot deformity. Painful hallux valgus is present and is associated with dislocation of the lesser metatarsophalangeal joints. The recommended surgical treatment is:

1) Bunionectomy, first metatarsal osteotomy, and arthroplasty of the lesser metatarsophalangeal joints
3) Arthrodesis hallux metatarsophalangeal joint and resection of the lesser metatarsal heads
2) Resection arthroplasty (Keller procedure) of the first metatarsophalangeal joint and arthroplasty of the lesser metatarsophalangeal joints
5) Resection of all of the metatarsal heads
4) Bunionectomy, first metatarsal osteotomy, and resection of the lesser metatarsal heads

The gold standard surgical treatment for rheumatoid patients with severe forefoot deformities is first metatarsophalangeal fusion with second through fifth metatarsal head resections.Correct Answer: Arthrodesis hallux metatarsophalangeal joint and resection of the lesser metatarsal heads

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1036. (317) Q3-432:

The most common complication following triple arthrodesis in the adult patient is:

1) Malunion of the arthrodesis
3) Ankle instability
2) Nonunion of the arthrodesis
5) Transverse tarsal arthritis
4) Ankle arthritis

Each of the possible answers may occur following triple arthrodesis. In numerous studies, ankle arthritis is the complication most likely to occur regardless of the underlying disease process.Correct Answer: Ankle arthritis

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1037. (318) Q3-433:

A pantalar arthrodesis is described as a:

1) Subtalar and tibiotalar arthrodesis
3) Ankle and triple arthrodesis
2) Tibiotalocalcaneal arthrodesis
5) Ankle arthrodesis and transverse tarsal arthrodesis
4) Triple arthrodesis and transverse tarsal arthrodesis

A pantalar arthrodesis is the combination of an ankle and triple arthrodesis. It should not be confused with an ankle and subtalar arthrodesis (tibiotalocalcaneal).Correct Answer: Ankle and triple arthrodesis

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1038. (319) Q3-434:

A 23-year-old woman with a bilateral leg and foot deformity presents for evaluation. She has weakness in the foot and ankle, giving way of the ankle, and difficulty with exercise activities. She mentions that both her brother and uncle have similar problems and deformities with their limbs. On examination, she has a cavovarus foot deformity and muscle weakness. The most likely combination of muscle loss is:

1) Anterior tibial and intrinsic muscles
3) Peroneus brevis, anterior tibial, and intrinsic muscles
2) Peroneus longus, peroneus brevis, and intrinsic muscles
5) Peroneus longus, extensor hallucis longus, and intrinsic muscles
4) Posterior tibial, anterior tibial, and peroneus longus muscles

By history, this patient has hereditary sensorimotor neuropathy (Charcot-Marie-Tooth disorder). Historically referred to as peroneal muscular atrophy, this condition initially affects the peroneus brevis, followed by the intrinsic and anterior tibial muscles. Other patterns of deformity and muscle loss are occasionally present.Correct Answer: Peroneus brevis, anterior tibial, and intrinsic muscles

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1039. (320) Q3-435:

A 63-year-old woman presents for evaluation and treatment of a painful bunion deformity. She has a moderate hallux valgus deformity. Pain and crepitus are present with range of motion of the hallux metatarsophalangeal joint. The hallux valgus deformity measures 25Â° and the intermetatarsal angle is 14Â°. The recommended surgical procedure is:

1) Distal metatarsal osteotomy
3) Distal soft tissue release and proximal metatarsal osteotomy
2) Proximal metatarsal osteotomy
5) Distal soft tissue release and first metatarsal cuneiform arthrodesis
4) Metatarsophalangeal joint arthrodesis

Although resection arthroplasty (Keller procedure) may be a reasonable alternative, arthrodesis of the hallux metatarsophalangeal joint is required in the presence of arthritis. Other alternatives, such as osteotomies, are impractical.Correct Answer: Metatarsophalangeal joint arthrodesis

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1040. (321) Q3-436:

The nerve commonly associated with painful heel syndrome is the:

1) Medial plantar nerve
3) First branch of the lateral plantar nerve
2) Lateral plantar nerve
5) Deep peroneal nerve
4) Calcaneal nerve

The first branch of the lateral plantar nerve (occasionally referred to as the nerve to the abductor digiti quinti) is occasionally involved in pathologic painful heel syndrome and plantar fasciitis.Correct Answer: First branch of the lateral plantar nerve

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1041. (322) Q3-437:

A 63-year-old woman with diabetes has had an ulcer under the plantar aspect of the foot for 3 months. The ulcer extends from the inferior aspect of the heel pad toward the midfoot. Nonoperative measures have failed to heal the ulcer. The amputation that is most likely to be successful is a:

1) Midfoot amputation with a skin graft
3) Below the knee amputation
2) Symeâs amputation
5) Transverse tarsal amputation
4) Transmetatarsal amputation

A foot salvage amputation, including the transarticular ankle amputation (Symeâs amputation), will not work in the presence of a disrupted heel pad (with or without ulceration) and infection of the heel.Correct Answer: Below the knee amputation

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1042. (323) Q3-438:

A 56-year-old man has a painful flatfoot deformity. Attempts at orthotic support and bracing of the foot have not been successful. On examination, the forefoot is abducted, the heel is fixed in valgus, and the subtalar joint is rigid. The operation that is most likely to correct the foot deformity is:

1) Flexor digitorum longus transfer into the navicular
3) Transverse tarsal arthrodesis
2) Calcaneus osteotomy
5) Lateral column lengthening calcaneus osteotomy
4) Triple arthrodesis

By history and physical examination, this patient has a Stage III flatfoot deformity. Due to the rigidity, only an arthrodesis will correct this abnormality. Although a transverse tarsal arthrodesis (Chopartâs arthrodesis) may adequately correct the deformity, a triple arthrodesis will correct all of the components including heel valgus, forefoot abduction, and midfoot pronation.Correct Answer: Triple arthrodesis

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1043. (324) Q3-439:

A 54-year-old woman with a 10-year history of diabetes presents for treatment of a non-healing ulcer that has been present under the plantar aspect of her second metatarsal for 9 months. The ulcer is 1.5 cm in diameter, is associated with mild serous drainage, and has shown no radiographic changes. She has normal circulation to the forefoot. The recommended treatment is:

1) Osteotomy second metatarsal
3) Shoe wear modification
2) Resection of the second metatarsal head
5) Orthotic shoe support and shoe modification
4) Total contact cast

Management of the non-infected plantar neuropathic ulcer is nonoperative, with the exception of refractory recurrent ulceration. In this case, surgery may be indicated. The most reliable means of healing the ulcer is with the use of a total contact cast that permits immediate ambulation and protection for the rest of the foot. Shoe modifications are required following healing of the ulcer but are insufficient as part of the initial treatment program.Correct Answer: Total contact cast

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1044. (325) Q3-440:

A patient presents for treatment in your emergency department following an injury that he sustained 4 hours earlier. His foot was run over by a piece of heavy industrial equipment. On examination, he has pain in the foot, a displaced fracture of the second metatarsal, a 3-cm area of severe contusion over the forefoot, and numbness of the dorsal surface of the foot. The next examination that you recommend is:

1) Measurement of compartment pressures in the foot
3) Computerized axial tomography of the midfoot
2) Magnetic resonance imaging of the tarsometatarsal joint
5) Laser Doppler flowmetry
4) Doppler evaluation of the foot pulses

Because of his history, this patient may have a compartment syndrome of the foot. Although other studies may be relevant as part of his evaluation, a compartment syndrome mandates emergency treatment. Vascular evaluation, including laser Doppler flowmetry is unreliable in diagnosing compartment syndrome. Imaging studies may be performed as part of the surgical work-up, but they are not indicated at this time.Correct Answer: Measurement of compartment pressures in the foot

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1045. (326) Q3-441:

A 63-year-old woman presents for treatment of pain and a burning/tingling sensation along the medial aspect of the foot and hallux. She underwent a tarsal tunnel release 12 months ago, but she has not experienced much symptomatic relief. Upon clinical examination, she has a positive percussion test (Tinel sign) along the course of the distal tibial nerve and pain upon pressure of the tarsal canal. There are no other pertinent clinical findings and a magnetic resonance image does not reveal any pathologic lesion. The next course of treatment is:

1) Multiple cortisone injections
3) Repeat release of the tarsal tunnel, specifically of the medial plantar nerve
2) Implantation of a peripheral nerve stimulator
5) Nerve desensitization with peripheral nerve stimulation
4) Multiple sessions of physical therapy

This patient presents with symptoms of a tarsal tunnel syndrome, specifically involving the medial plantar nerve. Because she did not experience any initial pain relief from her surgery, one may suspect that an inadequate release was initially performed. Cortisone injection and physical therapy have no role in the management of a recurrent tarsal tunnel syndrome, although desensitization treatments with neuroleptic medication and manual massage are beneficial following surgery. It is important to rule out a sympathetically mediated pain syndrome prior to embarking on repeat surgery.Correct Answer: Repeat release of the tarsal tunnel, specifically of the medial plantar nerve

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1046. (327) Q3-442:

Slide 1

For 3 years, a 23-year-old female gymnast has experienced recurrent ankle sprains associated with a sense of instability of the hindfoot. Upon examination, a positive anterior drawer test is present and stress radiographs are taken. She has attempted rehabilitation numerous times. She is unable to compete with her current symptoms. The recommended treatment is:

1) Reconstruction of subtalar instability with the peroneus brevis tendon
3) Reconstruction of ankle instability with the split peroneus brevis (Evans procedure)
2) Reconstruction of ankle instability with an anatomic repair (Brostrom procedure)
5) Arthroscopic evaluation of ankle joint followed by reconstruction with split peroneus brevis tendon
4) Reconstruction of ankle instability with the split peroneus brevis (Chrisman-Snook procedure)

For athletes, particularly those involved in activities that require repetitive proprioceptive and balance activities of the foot and ankle, an anatomic repair (Brostrom procedure) with addition of the extensor retinaculum (Gould modification) is the only procedure that will allow this individual to return to athletic activity. Surgeons must not sacrifice the peroneal tendon, or part thereof, since this may unnecessarily weaken the foot.Correct Answer: Reconstruction of ankle instability with an anatomic repair (Brostrom procedure)

1047. (328) Q3-443:

Figure 1

A 31-year-old recreational soccer player presents for evaluation of chronic ankle pain during physical activity. He reports a severe inversion ankle sprain that occurred 1 year ago and notes that he was treated with cast immobilization. Upon examination, he does not demonstrate laxity of the ankle ligaments and pain is present along the anterior medial ankle. A radiograph is presented. The recommended treatment is:

1) Ankle arthrotomy and excision of loose body
3) Retrograde drilling and bone graft
2) Ankle arthrotomy and ankle synovectomy
5) Arthroscopic debridement and drilling
4) Osteochondral autograft procedure

This patient has an osteochondral defect of the talus. According to most classification systems, the grade of the defect is not severe. Retrograde drilling of the defect through the sinus tarsi is possible for a posteromedial lesion of the talus for which the cartilage surface is intact. An autogenous osteochondral bone graft is indicated for a severe lesion with bone loss or following failure of previous attempts at arthroscopic drilling. The ideal procedure is arthroscopic debridement and drilling of the subchondral bone.Correct Answer: Arthroscopic debridement and drilling

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1048. (329) Q3-444:

Figure 1 **Figure 2**

A 43-year-old woman has had a 2-year history of ankle pain. Her ankle pain is associated with swelling, decreased activities, and limited range of motion. Upon examination, diffuse warmth and swelling of the ankle are noted. Radiographs and a clinical picture are presented. The most likely diagnosis is:

1) Rheumatoid arthritis
3) Septic arthritis
2) Gout
5) Pigmented villonodular synovitis (PVNS)
4) Synovial sarcoma

Although pigmented villonodular synovitis (PVNS), infection, or gout may cause inflammatory changes on both sides of the ankle joint, the most likely cause of this inflammatory arthropathy is rheumatoid arthritis. Note the cystic changes, the synovial hypertrophy, and the joint inflammation.Correct Answer: Rheumatoid arthritis

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1049. (330) Q3-445:

A 25-year-old football player sustained an injury to his ankle 2 months ago. He has ankle pain upon dorsiflexion and external rotation. A radiograph demonstrates widening of the tibiofibular syndesmosis and a 3-mm space between the medial talus and the medial malleolus. The recommended treatment is:

1) Open reduction and internal fixation of a high fibula fracture
3) Repair of the high ankle sprain with syndesmosis screw
2) Reconstruction with peroneus brevis followed by aggressive rehabilitation of the ankle
5) Ankle arthroscopy, synovectomy, and repair of the deltoid ligament
4) Arthrodesis of the tibiofibular syndesmosis

It is imperative that any diastasis of the tibiofibular joint is repaired to prevent the late sequelae (e.g., arthritis), particularly in the athlete. Arthroscopy is not sufficient, other than evaluation for additional joint pathology, and syndesmosis arthrodesis would rarely be indicated for this condition. There is no evidence of a high fibula fracture, although this must be a concern and should always be considered.Correct Answer: Repair of the high ankle sprain with syndesmosis screw

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1050. (331) Q3-446:

A patient presents for surgical treatment of a third web space neuroma. She inquires as to the potential for complications from the procedure. You inform her that the recurrence rate following excision is approximately:

1) 2%
3) 15%
2) 5%
5) 35%
4) 25%

The reported recurrence rate following excision of a primary interdigital neuroma is approximately 15%. The recurrence rate should always be communicated to the patient preoperatively.Correct Answer: 15%

1051. (332) Q3-447:

While he is working, an industrial worker sustains a puncture wound to the plantar aspect of his foot. He suspects the wound was caused by a sharp protruding nail that penetrated his sneaker. The most likely organism to be responsible for a subsequent infection is:

1) Staphylococcus aureus
3) Staphylococcus epidermidis
2) Pseudomonas aeruginosa
5) Enterobacter
4) Streptococcus viridans

Although one must be concerned about the possibility of a Pseudomonas infection, the most common organism following puncture injury is staphylococcus aureus. Unless in the setting of diabetes or immune compromise, anaerobic infection rarely occurs.Correct Answer: Staphylococcus aureus

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1052. (333) Q3-448:

A 54-year-old woman sustained an injury to her knee 16 months ago. She describes the injury as a dislocation, and she was treated with ligament reconstruction. She has plantarflexion and inversion strength, absent ankle dorsiflexion, and weak eversion. She desires an improvement in the function of the ankle and the ability to comfortably ambulate. The ideal treatment for her is:

1) Ankle arthrodesis in a neutral position
3) Neurolysis of the common peroneal nerve
2) Intramembranous transfer of the posterior tibial tendon
5) Dorsal transfer of the peroneus brevis and longus tendons
4) Nerve graft of the common peroneal nerve

Following peroneal nerve injury, varying degrees of plantarflexion weakness may be present. In the patient with an intact and strong posterior tibial muscle, an intramembranous transfer to the dorsum of the foot may yield positive results with possible active dorsiflexion. Although neurolysis or nerve graft may be considered for selected patients, it is unlikely to yield a satisfactory result at this time following injury.Correct Answer: Intramembranous transfer of the posterior tibial tendon

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1053. (334) Q3-449:

A 61-year-old man has been treated for type I diabetes for 6 years and presents for evaluation and treatment of an ulcer on the plantar aspect of the forefoot. The ulcer has been present for 4 weeks. The ulcer does not appear infected, claw toe deformities are present, and a posterior tibial pulse is palpable. An important screening test for this patient is:

1) Doppler ultrasound
3) Combined technetium-indium scan
2) 128-MHz tuning fork examination
5) Transcutaneous oxygen measurements
4) Semmes-Weinstein monofilament testing

Although vascular evaluation of all patients with diabetes is important, this patient has a neuropathic plantar ulcer and it is important to assess the extent of neuropathy. The Semmes-Weinstein monofilament is a first-rate screening tool.Correct Answer: Semmes-Weinstein monofilament testing

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1054. (335) Q3-451:

The most common complication following medial subtalar dislocation with incarceration of the talus in the extensor brevis muscle is:

1) Avascular necrosis talus
3) Tarsal tunnel syndrome
2) Ankle arthritis
5) Peroneal tendonitis
4) Subtalar joint arthritis

A medial peritalar dislocation is easy to reduce even when the head of the talus is incarcerated in the extensor brevis muscle. Following reduction, stiffness and arthritis of the subtalar joint occurs. Ankle arthritis and tarsal tunnel syndrome may occur following lateral subtalar dislocation.Correct Answer: Subtalar joint arthritis

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1055. (336) Q3-453:

Figure 1

A patient sustained a fracture of the calcaneus 9 months ago. The fracture was treated with non-weight bearing and cast immobilization. The patient experiences constant pain and is unable to work. On examination, he has limited inversion, eversion motion of the foot, and lateral foot pain. Radiographs are presented. The recommended treatment is:

1) Physical therapy aimed at increasing subtalar joint motion
3) Triple arthrodesis
2) Nonsteroidal anti-inflammatory medication and orthotic treatment
5) Subtalar arthrodesis
4) Osteotomy of calcaneus and debridement of peroneal tendonitis

In the presence of stiffness of the subtalar joint, physical therapy modalities are unlikely to improve the foot function. For the young active worker, an early subtalar arthrodesis is the most reliable procedure to return him to work and an active lifestyle. A triple arthrodesis is contraindicated in the absence of painful transverse tarsal arthritis.Correct Answer: Subtalar arthrodesis

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1056. (337) Q3-454:

Figure 1

A 44-year-old woman presents with chronic pain in the region of the forefoot. She is unable to wear a shoe with a heel and she has pain in the region of the second toe. On examination, she has swelling of the second toe and painful inflammation of the metatarsophalangeal joint. A clinical picture of her foot is presented. Your initial treatment consists of:

1) Rigid shoe and a toe splint
3) Semirigid orthotic support
2) Cortisone injection
5) Nonsteroidal anti-inflammatory medication and physical therapy treatments
4) Night splinting of the second toe

This patient has idiopathic synovitis of the second metatarsophalangeal (MP) joint. This may be associated with hallux valgus or a long second metatarsal, leading to attritional changes in the volar plate and secondary instability of the MP joint. Immobilization of the toe with limitation of dorsiflexion is required. Although cortisone injection may be effective, toe support must be the initial form of treatment.Correct Answer: Rigid shoe and a toe splint

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1057. (338) Q3-455:

The most reliable clinical finding of an acute compartment syndrome of the foot is:

1) Absent pulses
3) Diminished sensation along the dorsal foot surface
2) Diminished sensation along the plantar medial foot
5) Pain upon passive dorsiflexion of the toes
4) Marked tense foot swelling and pain

The most reliable clinical finding of an acute compartment syndrome of the foot is pain upon passive dorsiflexion of the toes. Decreased sensation does not occur commonly and is a late finding, along with changes in perfusion to the foot.Correct Answer: Pain upon passive dorsiflexion of the toes

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1058. (339) Q3-456:

A 9-year-old girl presents for treatment of a calcaneus deformity of the foot that has progressively worsened over the past 3 years. She has a history of poliomyelitis. Upon examination, she has poor plantarflexion, neutral varus and valgus of the hindfoot, and strong dorsiflexion. The preferred treatment for this deformity is:

1) Posterior transfer of the posterior tibial tendon to the fibula
3) Posterior transfer of the posterior tibial and peroneal tendons to the calcaneus
2) Posterior transfer of the anterior tibial tendon to the calcaneus
5) Ankle arthrodesis in slight plantarflexion
4) Pantalar arthrodesis

A calcaneus deformity is ideally treated with posterior transfer of the anterior tibial tendon to the calcaneus. In the presence of calcaneovalgus deformity (which is not present in this child), posterior transfer to the fibula is a better procedure to prevent continued valgus deformity of the ankle.Correct Answer: Posterior transfer of the anterior tibial tendon to the calcaneus

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1059. (340) Q3-457:

Figure 1

A 54-year-old woman presents for treatment of leg weakness. She is unable to walk up stairs. She recalls an injury to her ankle while playing tennis 1 year ago. Upon examination, she has poor plantarflexion strength, but excellent dorsiflexion and inversion strength. A magnetic resonance image of her leg is presented. The recommended treatment is:

1) Transfer of the flexor hallucis longus muscle to the calcaneus
3) Transfer of the anterior tibial tendon to the distal Achilles tendon
2) Repair of the Achilles tendon
5) Transfer of the posterior tibial and peroneus brevis tendons to the calcaneus
4) Transfer of the anterior tibial tendon to the calcaneus

This patient sustained a rupture of the Achilles tendon that went untreated for 1 year. She has symptomatic weak plantarflexion that may be improved by tendon transfer. Achilles repair is not possible due to the size of the defect. Although transfer of the peroneus brevis muscle or the flexor digitorum longus muscle has been described for correction of plantarflexion weakness, the flexor hallucis longus muscle is stronger and a better transfer.Correct Answer: Transfer of the flexor hallucis longus muscle to the calcaneus

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1060. (341) Q3-458:

Figure 1

A 19-year-old collegiate lacrosse player presents for treatment of acute pain along the lateral aspect of the foot. The pain developed during a preseason game 1 week ago. A radiograph is presented. The treatment that will return the athlete to playing competitively with the least likelihood of complications is:

1) Open reduction and internal fixation
3) Cast immobilization and non-weight bearing
2) Open reduction and bone grafting
5) Percutaneous screw fixation
4) Removable boot immobilization, weight bearing, and pool therapy

To rapidly return the competitive athlete to full function, percutaneous screw fixation of an acute fracture or a stress fracture of the fifth metatarsal at the junction of the metaphysis and diaphysis is preferred treatment. Although nonoperative treatment is associated with fracture healing, the limited function and requirement for immobilization, and possibly limited weight bearing, makes this alternative less appealing in the athlete.Correct Answer: Percutaneous screw fixation

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1061. (342) Q3-459:

Figure 1

A 19-year-old woman presents for treatment of a painful hallux valgus deformity. In addition to the foot deformity, she has spastic hemiplegic cerebral palsy. A clinical picture of her foot is presented. The recommended treatment is:

1) Distal metatarsal osteotomy
3) Distal metatarsal and proximal hallux phalangeal osteotomy
2) Proximal metatarsal osteotomy
5) Arthrodesis hallux metatarsophalangeal (MP) joint
4) Tendon transfer of the adductor hallucis to the abductor hallucis

In patients with spasticity, arthrodesis of the hallux metatarsophalangeal joint is the only reliable means of controlling the hallux and preventing recurrent deformity.Correct Answer: Arthrodesis hallux metatarsophalangeal (MP) joint

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1062. (343) Q3-460:

The most common complication of arthrodesis of the proximal interphalangeal (PIP) joint is:

1) Claw toe deformity
3) Hammer toe deformity
2) Mallet toe deformity
5) Instability of metatarsophalangeal (MP) joint
4) Curly toe deformity

With arthrodesis of the proximal interphalangeal joint (PIP), the long flexor tendon that remains intact flexes the toe at the metatarsophalangeal (MP) joint and also at the distal interphalangeal (DIP) joint, thus the development of a mallet toe deformity.Correct Answer: Mallet toe deformity

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1063. (344) Q3-461:

Figure 1

A 59-year-old woman presents for treatment of a painful hallux valgus deformity. She has a prominent bunion, normal motion of the hallux metatarsophalangeal (MP) joint, and painful callosity under the second MP joint. Radiographs of the foot are presented. The recommended treatment is:

1) Arthrodesis of the hallux MP joint
3) Soft tissue release and proximal metatarsal osteotomy
2) Soft tissue release and distal metatarsal osteotomy
5) Resection arthroplasty of the hallux MP joint
4) Soft tissue release and arthrodesis metatarsocuneiform joint

This patient has probable instability of the metatarsocuneiform joint manifested by the overload phenomenon of the second metatarsal. Although this is not a sufficient indication for performing an arthrodesis of the metatarsocuneiform joint (modified Lapidus procedure), other findings of second metatarsal overload, including thickening of the cortex of the second metatarsal and instability of the first metatatarsocuneiform joint, should be looked for in addition to hypermobility of the first ray.Correct Answer: Soft tissue release and arthrodesis metatarsocuneiform joint

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1064. (345) Q3-464:

In surgical correction of the adult acquired flatfoot deformity, a medial translational calcaneal osteotomy is often performed in conjunction with additional soft tissue correction medially. One of the proposed biomechanical effects of the osteotomy associated with improvement in the arch of the foot is:

1) Weakening the peroneus brevis tendon
3) Tightening the lateral plantar ligament
2) Tightening the plantar fascia
5) Medial shift of the Achilles tendon
4) Depression of the first metatarsal axis

The medial shift of the calcaneus effectively moves the Achilles tendon, thereby increasing the medial torque on the subtalar joint. The valgus deforming force of the Achilles on the heel is neutralized. The plantar fascia is lengthened, not tightened, by the medial shift of the calcaneus.Correct Answer: Medial shift of the Achilles tendon

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1065. (346) Q3-466:

One year ago, a patient underwent a triple arthrodesis for management of a severe foot deformity. Although the deformity of her foot is notably improved since the surgery, she has not walked comfortably and the pain is worse than it had been prior to surgery. Upon clinical examination, she is noted to have a fixed supination deformity of the forefoot and callosity under the base of the fifth metatarsal. The recommended management of this problem is:

1) Semirigid orthotic shoe support
3) Calcaneal osteotomy
2) Bracing with a dynamic ankle foot orthoses
5) Revision triple arthrodesis
4) Excision of the base of the fifth metatarsal

This patient underwent a triple arthrodesis that resulted in malunion as demonstrated by the location of the callosity and the fixed forefoot deformity.

- A calcaneus osteotomy will not correct the midfoot deformity.
- Nonoperative treatment will not be sufficient in long-term management.

Correct Answer: Revision triple arthrodesis

1066. (347) Q3-467:

A 28-year-old woman presents for treatment of pain and swelling in the foot. She had twisted her ankle 2 months ago and her initial treatment consisted of limited activity, crutches, and immobilization. Because she has not been able to wean off the crutches, she has pain in the foot radiating to the ankle and distal lateral leg. She has constant pain in the foot and the swelling appears worse than at the time of her injury. Clinically, there are multiple areas of tenderness in the foot and ankle that appear swollen and sensitive to examination. The study that would be most helpful to clarify this diagnosis is:

1) Magnetic resonance imaging examination of the ankle
3) Ultrasound examination of the ankle ligaments
2) Weight-bearing radiographs of the ankle and foot
5) Computerized axial tomography scan of the ankle and subtalar joint
4) Technetium bone scan

This patient appears to have an acute sympathetically mediated pain syndrome. Previously referred to as reflex sympathetic dystrophy, it is essential to make an early diagnosis and initiate treatment. While a lumbar sympathetic block has both diagnostic and therapeutic value, a bone scan is an excellent imaging study for screening and diagnostic purposes in this patient.Correct Answer: Technetium bone scan

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1067. (348) Q3-468:

A 52-year-old man presents for evaluation and treatment of a painful flatfoot deformity. While playing tennis 2 years ago, he felt a tearing sensation in his foot and ankle. Since that time, he notes that the arch of his foot has become progressively flatter. Upon examination, he has a flatfoot inability to perform a single heel rise and weak inversion strength. He desires to have this deformity corrected. At surgery, the posterior tibial tendon is grossly normal in appearance. The most likely source of his deformity is:

1) Rupture of the Achilles tendon
3) Rupture of the plantar fascia
2) Rupture of the peroneus longus tendon
5) Rupture of the inferolateral long plantar ligament
4) Rupture of the spring ligament

A rupture of the spring ligament, the talonavicular capsule, or the deltoid ligament should be looked for in the patient with an acquired flatfoot following trauma. Intratendinous tear of the posterior tibial tendon is also possible.Correct Answer: Rupture of the spring ligament

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1068. (349) Q3-471:

A 27-year-old man sustained an injury to his foot 2 Â½ years ago when a forklift crushed his foot. He sustained a fracture dislocation of the midfoot and was treated with open reduction and internal fixation. His current complaints are burning in the foot associated with numbness over the dorsal foot surface. On examination, he has severe focal sensitivity over the dorsal foot, particularly in the first web space radiating proximally to the ankle. Radiographs demonstrate mild arthritis and anatomic reduction of the tarsometatarsal and midfoot joints. The prognosis for relief of his foot pain at this stage is:

1) Excellent with neuroleptic medication and physical therapy
3) Good with treatment for a sympathetically mediated pain syndrome
2) Fair regardless of the treatment provided
5) Good with biofeedback and job modification
4) Excellent following tarsal tunnel release

This patient sustained a crush injury to the foot, and although the dislocation was apparently treated with anatomic reduction, he experiences focal neuritis. It is unlikely that he has a sympathetically mediated pain syndrome, although this should always be considered. The outcome, regardless of treatment, must be guarded for this post-traumatic crush syndrome.Correct Answer: Fair regardless of the treatment provided

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1069. (350) Q3-472:

A 34-year-old woman presents for treatment of pain in the hallux. She notes pain upon weight bearing and wearing high-heel shoes. Upon examination, the range of motion of the hallux metatarsophalangeal (MP) joint is 10Â° dorsiflexion and 30Â° plantarflexion, with pain upon passive dorsiflexion. Radiographs demonstrate osteophytes over the dorsal surface of the metatarsal head, maintenance of the joint space, and a metatarsal declination angle of 10Â°. The first metatarsal is elevated above the second metatarsal at the level of the metatarsal neck by 4 mm. The ideal procedure to correct this problem and alleviate pain is:

1) Plantarflexion osteotomy first metatarsal neck
3) Dorsiflexion osteotomy first metatarsal neck
2) Plantarflexion osteotomy first metatarsal base
5) Arthrodesis hallux MP joint
4) Cheilectomy first metatarsal and dorsiflexion osteotomy hallux proximal phalanx

This patient has mild hallux rigidus with a normal alignment of the first metatarsal. The average elevation of the first metatarsal above the second metatarsal at the level of the metatarsal neck is 7.5 mm, thus, 4 mm is within normal limits. Arthrodesis is not indicated for mild rigidus and osteotomy is indicated only for severe elevation of the first metatarsal. Cheilectomy combined with osteotomy of the proximal phalanx (the Moberg osteotomy) is the preferred procedure.Correct Answer: Cheilectomy first metatarsal and dorsiflexion osteotomy hallux proximal phalanx

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1070. (351) Q3-473:

A patient experienced a nondisplaced fracture of the medial and middle cuneiforms. His nonoperative treatment consisted of cast immobilization for 2 weeks with no weight bearing permitted, followed by ambulation as tolerated. He presents for treatment 1 week later with severe swelling in the foot, stiffness of the toes, and limited motion of the hindfoot. The fracture of the cuneiforms appears healed. The ideal management of the stiffness and swelling of the foot is:

1) Application of an intermittent foot pump compression device
3) Removable stirrup brace and anti-inflammatory medication
2) Continued cast immobilization and weight bearing as tolerated
5) Cast immobilization with frequent changes to monitor swelling
4) Deep friction massage combined with acupuncture treatments

Patients who develop swelling of the foot and ankle following trauma and surgery can be effectively treated with application of an intermittent foot pump device. The bladder of the foot pump can be inserted into either a removable boot or cast, or applied to the foot in combination with other methods of rehabilitation. The foot pump is an effective device for decreasing swelling of the foot in association with acute trauma.Correct Answer: Application of an intermittent foot pump compression device

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1071. (352) Q3-474:

A 31-year-old woman presents for treatment of pain in the hallux. She has been experiencing the pain for 2 years. She notes limited motion of the hallux with pain in the joint, particularly when wearing high-heel shoes. She is unable to toe off with running activities. Upon examination, the motion in the hallux metatarsophalangeal (MP) joint is limited in dorsiflexion and radiographs demonstrate mild arthritis of the joint. She requests surgery to correct this disorder. The recommended treatment is:

1) Arthrodesis hallux MP joint
3) Plantarflexion osteotomy of the first metatarsal base
2) Plantarflexion osteotomy of the first metatarsal neck
5) Dorsal cheilectomy metatarsal head
4) Dorsiflexion osteotomy of the metatarsal neck

Cheilectomy is the ideal treatment for correction of mild hallux rigidus. Although elevation of the first metatarsal rarely occurs (metatarsus primus elevatus) as the cause for hallux rigidus, osteotomy of the metatarsal should not be used as the treatment for correction of hallux rigidus with normal alignment of the first metatarsal.Correct Answer: Dorsal cheilectomy metatarsal head

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1072. (353) Q3-475:

A 17-year-old woman presents for evaluation of a painful hallux valgus deformity. She is unable to wear shoes comfortably, has pain with athletic and daily activities, and notices that the deformity is gradually worsening. Upon clinical examination, she has generalized ligamentous laxity, with motion of the hallux metatarsophalangeal (MP) joint 75Â° dorsiflexion and 25Â° plantarflexion. Motion of the first metatarsal is approximately 8Â° to 10Â° of combined dorsiflexion and plantarflexion. There is no pain to range of motion of these joints. The hallux valgus angle is 28Â° and the 1-2 intermetatarsal angle is 12Â°. The recommended treatment is:

1) Arthrodesis of the first metatarsocuneiform joint (Lapidus)
3) Distal metatarsal osteotomy
2) Proximal metatarsal osteotomy
5) Arthrodesis of the hallux MP joint
4) Resection arthroplasty of the MP joint

This adolescent has symptomatic hallux valgus, and surgery is warranted. The motion at the metatarsophalangeal and talometatarsal joints is normal, and there is no evidence of hypermobility despite her generalized ligamentous laxity. Therefore, the modified Lapidus procedure is not indicated. With this deformity, a distal metatarsal osteotomy is ideal.Correct Answer: Distal metatarsal osteotomy

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1073. (354) Q3-476:

An 82-year-old woman presents for treatment of a painful second toe deformity. The toe is subluxated at the metatarsophalangeal (MP) joint, and a fixed claw toe deformity is present. Despite severe hallux valgus, and the hallux under riding the second toe, the hallux and bunion are not symptomatic. The procedure that will ideally correct this deformity is:

1) Resection arthroplasty hallux, MP, and proximal interphalangeal joint (PIP) arthroplasty second toe
3) Proximal metatarsal osteotomy first metatarsal, MP, and PIP arthroplasty second toe
2) Arthrodesis hallux MP joint, MP, and PIP arthroplasty second toe
5) MP and PIP arthroplasty second toe with flexor to extensor tendon transfer
4) Amputation second toe at the MP joint level

This elderly patient has a symptomatic second toe deformity only, and surgery to the hallux should be avoided if possible. This is a common clinical problem, and although patients do not readily accept amputation of the toe, it is the preferred procedure because it does not involve reconstruction of the hallux. Correction of the second toe without amputation will not work unless the hallux deformity is addressed.Correct Answer: Amputation second toe at the MP joint level

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1074. (355) Q3-477:

Figure 1

A 19-year-old woman had previously been treated for hallux valgus deformity with resection of the medial eminence only. She now presents with severe recurrent deformity of the hallux, with pain. There is neither pain nor crepitus upon range of motion of the hallux metatarsophalangeal (MP) joint. The procedure that will successfully correct the deformity of the hallux and the first metatarsal and maintain motion at the MP joint is:

1) Distal metatarsal osteotomy
3) Arthrodesis of the first talometatarsal joint (modified Lapidus)
2) Biplanar distal metatarsal osteotomy
5) Double first metatarsal osteotomy
4) Proximal metatarsal osteotomy

This patient has recurrent hallux valgus with a marked increase in the distal metatarsal articular angle (DMAA). Correction of this increased DMAA is essential to obtain motion at the metatarsophalangeal joint, and can only be accomplished with a closing wedge type of osteotomy distally. Although a distal biplanar osteotomy may be sufficient, in view of the magnitude of the deformity, a double first metatarsal osteotomy is preferred.Correct Answer: Double first metatarsal osteotomy

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1075. (356) Q3-478:

Figure 1

A 63-year-old woman who underwent attempted correction of a hallux valgus deformity 3 years previously presents to the office. She has pain in the hallux from dorsal abutment of the hallux on the shoe. There is no pain in the lesser toes or metatarsals. The recommended procedure to alleviate the irritation of the hallux is:

1) Arthrodesis of the hallux metatarsophalangeal (MP) joint
3) Bone block arthrodesis of the hallux MP joint
2) Resection arthroplasty of the MP joint (Keller)
5) Extensor hallucis lengthening
4) Joint replacement of the hallux MP joint

This patient had previously undergone resection arthroplasty (Keller) for correction. A common complication of this procedure is a cock-up toe deformity due to insufficiency of the short flexors. This can be corrected with lengthening of the extensor hallucis. If the latter procedure fails, then an arthrodesis can be performed.Correct Answer: Extensor hallucis lengthening

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1076. (357) Q3-479:

Figure 1 **Figure 2**

A 66-year-old woman has experienced the gradual onset of a flatfoot deformity over the past 10 years. She notes that the condition is bilateral, although worse on one side. Presented are clinical and radiographic images of her condition. This is associated with pain upon ambulation and difficulty with shoe wear. The most likely cause of this flatfoot deformity is:

1) Posterior tibial tendon tear
3) Neuropathy
2) Spring ligament tear
5) Tarsometatarsal arthritis
4) Subtalar arthritis

Although posterior tibial tendon insufficiency is a more common cause of adult acquired flatfoot, in this patient the associated clinical and radiographic deformity makes the diagnosis of tarsometatarsal arthritis more likely.Correct Answer: Tarsometatarsal arthritis

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1077. (358) Q3-480:

Slide 1 **Slide 2**

A 66-year-old woman has experienced the gradual onset of a flatfoot deformity over the past 10 years. She notes that the condition is bilateral, although worse on one side. Presented are clinical and radiographic images of her condition. This is associated with pain upon ambulation and difficulty with shoe wear. The most likely cause of this flatfoot deformity is tarsometatarsal arthritis. The initial recommended treatment is:

1) Tarsometatarsal arthrodesis
3) Triple arthrodesis
2) Flexor tendon transfer and osteotomy calcaneus
5) Corset type ankle-foot orthosis
4) Orthotic arch supports

The initial treatment of idiopathic tarsometatarsal arthritis in the adult is through foot support, shoe modifications, and orthoses. Tarsometatarsal arthrodesis may be required if these treatments fail.Correct Answer: Orthotic arch supports

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1078. (359) Q3-481:

Many materials are used in the production of orthotic arch supports. Plastizote is a material commonly used either alone or in combination. The problem with this material is:

1) It cannot be used in patients with neuropathy.
3) It is extremely expensive.
2) It is too hard a material for use with arthritis.
5) It softens and loses resilience quickly.
4) It increases sweating in the foot and is not well tolerated.

Plastizote is a remarkably forgiving material and accommodates well to the foot shape. It is soft, and it loses resilience or sponginess after 6 months. Therefore, plastizote is commonly used in combination with other materials for orthotic support, particularly for the patient with neuropathy.Correct Answer: It softens and loses resilience quickly.

1079. (360) Q3-482:

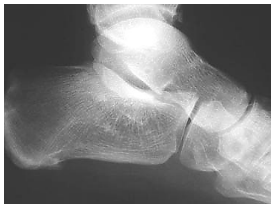

Figure 1

A 35-year-old man has experienced ankle pain for 7 years. It is associated with giving way and progressive deformity of the foot. He notices that the foot is rolling inward and is becoming flatter. The cause of his condition is:

1) Tarsal coalition
3) Talonavicular arthritis
2) Subtalar arthritis
5) Rupture spring ligament
4) Recurrent ankle sprains

This patient presents with ankle instability and progressively worsening flatfoot, with the hindfoot in valgus. Although a rare condition, this is caused by a talonavicular tarsal coalition, with increasing stress on the ankle likely.Correct Answer: Tarsal coalition

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1080. (361) Q3-483:

Figure 1

A 14-year-old boy presents for treatment of a painful foot, which has been present for 2 years. He has limited his athletic activities. He has similar symptoms in the opposite foot, although not as severe. On clinical examination, the alignment and appearance of the foot are normal; motion of the foot and ankle is good; and some discomfort is present in the sinus tarsi. Standard radiographs, of which the lateral view is presented, include anteroposterior, lateral, and oblique views. Because the diagnosis is unclear, more imaging studies are required. The next study to obtain is:

1) External oblique views of the foot
3) Oblique views of the subtalar joint (Broden)
2) Axial views of the subtalar joint (Harris)
5) Inclined views of the talonavicular joint (Canale)
4) Internal oblique views of the midfoot

The radiograph demonstrates changes in the subtalar joint suggestive of a middle facet coalition. Note the sclerosis of the joint surface. Although a computed axial tomography scan may be helpful, standard axial views of the subtalar joint (Harris) taken in the plane of the joint are usually diagnostic of tarsal coalition. Motion of the subtalar joint may be normal in the adolescent with a tarsal coalition.Correct Answer: Axial views of the subtalar joint (Harris)

1081. (362) Q3-484:

Figure 1

The radiograph of a 22-year-old woman with ankle pain and instability is presented. She has noted this problem for 10 years, and it appears to be worsening. The opposite ankle is not symptomatic. She has not had any previous treatment for foot or ankle problems. The cause of this ankle deformity is most likely to be associated with which of the following conditions:

1) Recurrent ankle instability
3) Subtalar fusion
2) Congenital bimalleolar dysplasia
5) Fibular hemimelic syndrome
4) Talar growth arrest

This patient has a ball and socket ankle, which results from limited motion of the hindfoot during early childhood, either from extensive tarsal coalition, premature hindfoot arthrodesis, or trauma. The condition most commonly associated with a ball and socket ankle is a form of hemimelia of the fibula with lateral ray deficiencies and associated tarsal coalition of which the latter is usually extensive.Correct Answer: Fibular hemimelic syndrome

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1082. (363) Q3-485:

The sustentaculum tali is the anatomic roof of which tendon:

1) Posterior tibial
3) Flexor digitorum brevis
2) Flexor digitorum longus
5) Flexor hallucis longus
4) Anterior tibial

The sustentaculum tali forms an arch under which the flexor hallucis longus passes. This is of anatomic significance when resecting middle facet tarsal coalition and performing subtalar arthrodesis.Correct Answer: Flexor hallucis longus

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1083. (364) Q3-487:

The nerve most likely to be at risk during surgical exposure when performing a triple arthrodesis is the:

1) Sural
3) Intermediate cutaneous branch superficial peroneal
2) Lateral cutaneous branch superficial peroneal
5) Dorsalis pedis
4) Lateral plantar

The sural nerve has a variable path in the distal leg, but lies immediately adjacent to the peroneal tendons on the lateral side of the foot. The lateral incision used to expose the subtalar and calcaneocuboid joints is adjacent to this nerve.Correct Answer: Sural

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1084. (365) Q3-488:

Slide 1

A 55-year-old man presents for treatment of pain in the Achilles tendon. This has been present for 2 years, but has suddenly become much worse. The pain is approximately 6 cm proximal to the insertion. He is unable to push off during walking and has pain when ascending stairs. Clinical examination reveals thickening of the tendon, weakness of the gastrocnemius-soleus, and pain upon squeezing the Achilles tendon. The magnetic resonance image is shown. The diagnosis is:

1) Xanthoma
3) Chronic paratendinitis
2) Degenerative tendinosis
5) Chronic rupture
4) Acute rupture

The widening and thickening over a length of the tendon noted clinically and on magnetic resonance image (MRI) is diagnostic of chronic degenerative tendinosis. While paratendinitis may be present simultaneously, limited MRI changes are noted in this condition. Rupture of the tendon may occur and patients with chronic tendinosis should recognize the potential for tendon rupture.Correct Answer: Degenerative tendinosis

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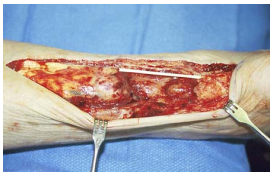
1085. (366) Q3-489:



Slide 1

A patient presents for surgical correction of a ruptured Achilles tendon. He recalls injuring his ankle 1 year previously, but did not seek any medical treatment at that time. You plan to repair the tendon, and at surgery, a gap between the tendon ends is noted (Slide). The following procedure is not consistent with an acceptable outcome:

1) V-Y advancement
3) End-to-end repair with the foot positioned in slight equinus
2) Flexor hallucis tendon transfer
5) Fascial turn down flap from musculotendinous junction
4) Flexor digitorum longus tendon transfer

End-to-end repair of a chronic rupture of the Achilles tendon may not be considered if the gap is greater than 2 cm. Equinus positioning is never acceptable. Although each of the other alternatives above may be considered, each has its proponents and potential disadvantages.Correct Answer: End-to-end repair with the foot positioned in slight equinus

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1086. (367) Q3-490:

You are commencing a repair of an acute rupture of the Achilles tendon that occurred 8 days previously in a 32-year-old recreational tennis player. Fibrillation of the tendon ends is noted. The following is most important to maximize the ultimate outcome of the repair:

1) Resection of the frayed tendon end, and end-to-end apposition
3) Repair of the tendon with the foot in slight equinus
2) Incorporation of the plantaris tendon in the repair
5) Repair with the tendon ends at normal resting tension
4) Augmentation of the repair with a facial turn down flap

Repair of the Achilles tendon at its normal resting length is critical. The frayed tendon ends should not be excised, since this will force a repair with the foot in equinus. The resting tension of the repair can be compared with the position of the opposite limb that should be prepared into the operative field.Correct Answer: Repair with the tendon ends at normal resting tension

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1087. (371) Q3-495:

Slide 1

A 17-year-old patient presents for evaluation and treatment of pain in the back of her ankle. She is a ballet dancer and has noticed that for the past year, she is unable to assume the pointe position without pain. Upon clinical examination she has full range of motion, excellent strength, normal toe function, and pain with pressure in the posterior ankle. The cause of her pain is:

1) Flexor hallucis longus tendonitis
3) Anterior tibial tendonitis
2) Osteochondral defect of the talus
5) Os trigonum syndrome
4) Peroneus longus tendonitis

Posterior ankle impingement is common in ballet dancers. When in the pointe position, maximum plantar flexion of the ankle is present, and pain may occur from impingement in the posterior ankle. Flexor hallucis tendonitis may cause posterior ankle pain, but there is no evidence for this condition here.Correct Answer: Os trigonum syndrome

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1088. (372) Q3-496:

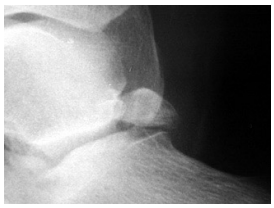

Figure 1

The structure that lies immediately medial to the bone prominence in the posterior ankle shown is the:

1) Tibial nerve
3) Peroneus brevis
2) Peroneus longus
5) Flexor hallucis longus
4) Posterior tibiofibular ligament

The os trigonum presented in the radiograph may be the cause of posterior ankle impingement. The flexor hallucis longus lies immediately medial to the os and must be protected during excision of this bone.Correct Answer: Flexor hallucis longus

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1089. (374) Q3-498:

Slide 1

A 43-year-old construction worker sustained a work-related injury to his foot 7 months ago. He was initially treated with cast immobilization and limited weight bearing. He has lateral foot pain and inability to walk comfortably. He has limited walking endurance. Upon examination, pain is present laterally along the course of the peroneal tendons, and no motion of the subtalar joint is present. The recommendation is:

1) Physical therapy followed by job modification
3) Nonsteroidal medication, and ankle foot orthoses
2) Shoe modification and orthotic support
5) Subtalar arthrodesis
4) Injection of the peroneal tendons with cortisone

A worker who sustains a calcaneus fracture must be returned to the work force as soon as possible. Although these alternatives for treatment may be considered in the patient with limited activity and low demands, the longer the time from injury to salvage surgery with arthrodesis, the less likely it is that the injured worker will ever return to gainful employment. Therefore, subtalar arthrodesis should be performed.Correct Answer: Subtalar arthrodesis

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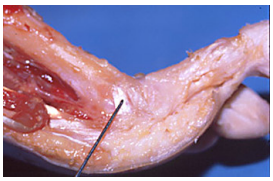
1090. (375) Q3-499:



Slide 1

The structure on the side of the metatarsophalangeal joint of the second toe which is marked by the pointer is the:

1) Lumbrical tendon
3) Collateral ligament
2) Volar plate ligament
5) Lateral joint capsule
4) Interosseous tendon

The structure is the volar plate ligament. This ligament may assume a pathologic role in claw toe deformity and instability of the metatarsophalangeal joint.Correct Answer: Volar plate ligament

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1091. (379) Q3-508:

Figure 1

A 21-year-old man presents for evaluation of high arches, which have been present his entire life. Currently, he is experiencing some discomfort with running activities. His brother and mother have high arches. He does not recall any trauma as a child, or any other pertinent childhood musculoskeletal problems. Clinical examination reveals a rigid deformity bilaterally. The most common cause for his high arches is:

1) Spina bifida
3) Hereditary sensorimotor neuropathy
2) Idiopathic cavovarus
5) Peroneal spastic foot
4) Polio

The most common cause of familial cavovarus foot deformity is hereditary sensorimotor neuropathy (Charcot-Marie-Tooth disease). This is an autosomal dominant condition with variable penetrance. Idiopathic cavus foot is common, but not familial, nor is it associated with this extensive deformity.Correct Answer: Hereditary sensorimotor neuropathy

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1092. (380) Q3-509:

Figure 1

A 21-year-old man presents for evaluation of high arches, which have been present his entire life. Currently, he is experiencing some discomfort with running activities. His brother and mother have high arches. He does not recall any trauma as a child, or any other pertinent childhood musculoskeletal problems. Clinical examination reveals a rigid deformity bilaterally. What structure is responsible for plantarflexion of the first metatarsal:

1) Peroneus longus tendon
3) Plantar fascia
2) Anterior tibial tendon
5) Flexor hallucis brevis
4) Flexor hallucis longus

The peroneus longus passes under the cuboid to function as a plantar flexor of the first metatarsal. It is a primary deforming force in the development of the cavus foot.Correct Answer: Peroneus longus tendon

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1093. (381) Q3-511:

A 22-year-old patient presents for treatment of a painful foot deformity. On examination, a flexible cavovarus deformity is present. The patient has good dorsiflexion foot strength, and eversion strength is weak. A possible tendon transfer that can be used to correct this deformity is:

1) Anterior tibial to middle cuneiform
3) Peroneus longus to peroneus brevis
2) Posterior tibial to peroneus longus
5) Posterior tibial to lateral cuneiform
4) Flexor digitorum to posterior tibial

Transfer of the strong peroneus longus to the weak peroneus brevis tendon can be considered to improve function and strength of the cavus foot. Posterior tibial tendon transfer is not indicated because dorsiflexion strength is good. Transfer of the anterior tibial tendon is not indicated, although it is contributing to the midfoot varus.Correct Answer: Peroneus longus to peroneus brevis

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1094. (382) Q3-513:

Figure 1 **Figure 2**

A 56-year-old man presents for treatment of chronic ankle pain. He has noted long-standing pain associated with activities since early adulthood. He does not have any other pertinent musculoskeletal history. Clinical and radiographic examinations reveal ankle arthritis. A probable cause for this arthritis and deformity is:

1) Recurrent ankle instability
3) Rheumatoid arthritis
2) Idiopathic osteoarthritis
5) Anterior ankle impingement syndrome
4) Post traumatic arthritis

The varus ankle deformity indicates either a chronic hindfoot varus and hindfoot cavus, or chronic recurrent instability of the ankle. If associated with rotatory instability, anterior impingement and eventual arthritis will occur.Correct Answer: Recurrent ankle instability

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1095. (383) Q3-515:

When performing fasciotomy of the foot for acute compartment syndrome, the muscle specifically decompressed through medial fasciotomy is:

1) Flexor hallucis brevis
3) Extensor hallucis brevis
2) Quadratus plantae
5) First dorsal interosseous
4) Abductor digiti minimi

Knowledge of the anatomy and pathophysiology of compartment syndrome of the foot is important to plan adequate and correct treatment. The exact number of compartments is not as relevant as the location and ability to decompress the compartment through fasciotomy. The medial compartment contains the abductor hallucis and the flexor hallucis brevis muscles. The quadratus plantae is more posteriorly located and considered to be in a separate calcaneal compartment.Correct Answer: Flexor hallucis brevis

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1096. (384) Q3-516:

This muscle group demonstrates electrical activity at the time of heel strike:

1) Anterior compartment
3) Lateral compartment
2) Intrinsic foot muscles
5) Medial compartment
4) Deep posterior compartment

The anterior muscle compartment, in particular, the anterior tibialis, is active during heel strike, to maintain foot dorsiflexion, and prevent foot drop during heel strike.Correct Answer: Anterior compartment

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1097. (386) Q3-518:

A 7-year-old boy presents with bilateral high arches. His parents report that they are having difficulty finding shoes that comfortably fit him. The patient denies any foot pain. The father had similar problems with his feet and was diagnosed with a âmildâ neurologic condition. On exam, the child has bilateral pes cavus with a supple hindfoot. Treatment of the feet at this time should consist of:

1) Soft tissue procedures alone
3) Triple arthrodesis
2) Soft tissue procedures and calcaneal osteotomy
5) Observation
4) Bracing

The child has a supple deformity secondary to Charcot-Marie-Tooth disease that will progress if untreated. Soft tissue procedures, which may consist of claw toe correction, plantar release, and possibly tendon transfer, are recommended for children younger than 8 years old who have a supple hindfoot.

- The calcaneal osteotomy is reserved for patients with a rigid hindfoot.
- Triple arthrodesis is a salvage procedure reserved for a fixed, painful foot in older children.
- Bracing and observation are not preferred options due to the progressive nature of the disease, and the lack of ability to apply corrective forces to the foot in cavus.

Correct Answer: Soft tissue procedures alone

1098. (387) Q3-519:

A 50-year-old woman presents with pain in the second toe. She describes this as burning and notes swelling of the toe for the past month. Upon examination, there appears to be instability of the toe with a positive dorsal subluxation stress test. The anatomic structure which is responsible for this patientâs symptoms is:

1) The deep transverse metatarsal ligament
3) The medial collateral ligament of the second metatarsophalangeal joint
2) The second common digital nerve
5) The flexor digitorum brevis
4) The plantar plate

This patient describes swelling of the toe, which is not associated with an interdigital neuroma. The pain, swelling, and clinical findings suggest a rupture of the plantar plate with early instability and second metatarsophalangeal synovitis.Correct Answer: The plantar plate

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1099. (389) Q3-522:

Figure 1

A 15-year-old boy presents with a 2-year history of pain in the foot associated with a sense stiffness and of giving way of the ankle. Upon examination, pain in the sinus tarsi, slightly decreased subtalar motion, and normal ankle motion with no apparent instability are noted. A lateral foot radiograph is presented. The next radiograph to obtain is:

1) Anteroposterior view of the ankle
3) Axial view of the hindfoot
2) Inversion stress view of the ankle
5) Anteroposterior view of the foot
4) 30Â° internal oblique view of the foot

This child presents with symptoms suggestive of a tarsal coalition. There is stiffness, and symptoms of ankle discomfort or instability. On the lateral radiograph, there is consolidation of trabeculation under the posterior facet in the shape of a âCâ, a typical finding of a middle facet coalition, which should be investigated further with an axial view of the subtalar joint (Harris).Correct Answer: Axial view of the hindfoot

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1100. (390) Q3-523:

Which ancillary test is not helpful in the diagnosis of Charcot-Marie-Tooth disease (CMT):

1) Electromyography (EMG)
3) Nerve biopsy
2) Nerve conduction velocity (NCV)
5) Muscle enzymes
4) Muscle biopsy

Charcot-Marie-Tooth disease (CMT) is a neuropathic process resulting in muscle atrophy, therefore, muscle enzyme studies will not be helpful.

- Electromyography (EMG) will confirm the diagnosis by displaying increased amplitude and duration of signals, both of which are indicative of a neuropathic process.
- Nerve conduction velocity (NCV) will also confirm the diagnosis by displaying decreased motor and sensory conduction velocities.
- Nerve biopsy can be helpful by showing loss of myelinated fibers and fibrosis.
- Muscle biopsy will show diffuse atrophy, fibrosis, and adipose tissue within muscle.

Correct Answer: Muscle enzymes

1101. (393) Q3-526:

A 67-year-old woman sustained a cerebrovascular accident 18 months previously, and has problems with ambulation. She notes that the ankle buckles with ground contact. Upon examination, she ambulates with slight circumduction of one limb, and heel varus is present during the swing and heel strike phases of gait. The procedure that would stabilize her foot during ground contact is:

1) Triple arthrodesis
3) Posterior tibial tendon transfer through the interosseous membrane
2) Subtalar arthrodesis
5) Posterior tibial tendon transfer to the peroneus longus
4) Split anterior tibial tendon transfer

A patient with persistent hindfoot varus during ground contact has an overactive anterior tibialis, which will cause a sense of instability upon heel strike. This can be effectively treated with a split anterior tibial tendon transfer, transferring half of the tendon more laterally to the lateral cuneiform or cuboid.Correct Answer: Split anterior tibial tendon transfer

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1102. (395) Q3-528:

Figure 1

A 19-year-old man presents for treatment in the emergency department following a motorcycle accident. He sustained an isolated injury to his foot and ankle. The recommended treatment is:

1) Primary talonavicular arthrodesis
3) Closed reduction cast immobilization
2) Open reduction internal fixation
5) Closed reduction percutaneous pin fixation
4) Closed reduction external fixation

The prognosis following fracture dislocation of the navicular is not good regardless of treatment. Although one may be tempted to perform an open reduction and immediate primary talonavicular arthrodesis, this is not necessary. Following open reduction and internal fixation, arthritis of the talonavicular joint may occur.Correct Answer: Open reduction internal fixation

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1103. (397) Q3-530:

A 23-year-old man sustains an injury to his foot when falling off a ladder. The foot is grossly twisted inward, and the talonavicular joint is dislocated with the talar head penetrating through the extensor brevis muscle. The dislocation is reduced. The likelihood of this resulting in avascular necrosis of the talus is:

1) Rare
3) 40%
2) 20%
5) 100%
4) 70%

Medial peritalar dislocation does not result in avascular necrosis of the talus. The development of subtalar arthritis is more likely.Correct Answer: Rare

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1104. (399) Q3-532:

Figure 1

A 53-year-old diabetic patient presents with an ulcer on the plantar aspect of the foot that has been present for 2 years. There is mild serous drainage; bone is not exposed. The recommended treatment is:

1) Wound culture, oral antibiotic therapy, and debridement
3) Debridement and split thickness skin grafting
2) Wound culture, intravenous antibiotic therapy, and debridement
5) Debridement and application of a total contact cast
4) Debridement, bone biopsy, and appropriate organism specific antibiotic therapy

This is a typical chronic plantar neuropathic ulcer. There is no evidence of acute infection by appearance, and therefore, no cultures or antibiotic therapy is required. Debridement of the ulcer margin only is useful followed by application of a total contact cast. Split thickness skin grafting is never indicated on the plantar foot surface in the setting of neuropathic ulceration.Correct Answer: Debridement and application of a total contact cast

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1105. (400) Q3-533:

Which of the following is not a feature of the foot deformity in Charcot-Marie-Tooth disease (CMT):

1) Hindfoot valgus
3) Plantarflexed 1st metatarsal
2) Forefoot pronation
5) Interphalangeal (IP) joint flexion
4) Metatarsophalangeal (MTP) joint hyperextension

Hindfoot varus develops to counter forefoot pronation due to weakness of evertors with preservation of inverter muscle strength.

- The first metatarsal plantarflexes relative to the other metatarsals, leading to pronation of the forefoot.
- Plantarflexion of the first metatarsal occurs as part of the windlass mechanism as the intrinsics and plantar fascia contract.
- As the intrinsics weaken, the toe extensors pull the metatarsophalangeal (MTP) joint into hyperextension as part of the claw toe deformity.
- When the MTP joint hyperextends, the strength of the long toe flexors pulls the interphalangeal joint into flexion contributing to the claw toe deformity.

Correct Answer: Hindfoot valgus

1106. (402) Q3-535:

Figure 1

A 32-year-old woman was treated surgically for ankle instability 2 years ago. She notes that her ankle is stable, but over the past year, she has noted progressive difficulty with the use of her big toe. She finds that her toe no longer touches the ground. This is confirmed upon pedobarograph testing, because there is no contact between the first metatarsal and the ground, which is an abnormal finding compared to her opposite foot. The appearance of the foot is presented. The probable cause for this is:

1) Injury to the flexor hallucis longus
3) Adhesions laterally to the peroneus brevis
2) Turf toe injury
5) Excessive scarring and malfunction of the posterior tibial tendon
4) Use of the peroneus longus in the ankle reconstruction

The primary function of the peroneus longus is to depress or plantarflex the first metatarsal and oppose the effect of the anterior tibialis on the base of the first metatarsal. The peroneus longus is no longer functioning, and first metatarsus elevatus is present.Correct Answer: Use of the peroneus longus in the ankle reconstruction

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1107. (404) Q3-537:

A 26-year-old woman presents for treatment of painful forefoot deformity. Hallux valgus is present, with a 35Â° angle, and arthritis of the metatarsophalangeal (MP) joint. The second and third lesser toe MP joints are dislocated with juxta-articular erosions of the fourth metatarsal head noted. The ideal surgical treatment is:

1) Silastic joint replacement of the hallux and osteotomy of the lesser metatarsals
3) Arthrodesis of the hallux MP joint and resection of the lesser metatarsal heads
2) Resection arthroplasty of the hallux and silastic arthroplasty of the lesser toe MP joints
5) Resection arthroplasties of all the MP joints
4) Bunionectomy, proximal metatarsal osteotomy, and resection arthroplasty of the lesser MP joints

For the patient with rheumatoid arthritis, stabilization of the hallux metatarsophalangeal joint is necessary, and a combination bunionectomy and metatarsal osteotomy is unlikely to succeed in the long-term when arthritis is present. Although shortening osteotomies of the lesser toe metatarsals may be considered to reduce the joint dislocations, this procedure has not yet been reported with long-term follow-up. Silastic joint replacement is not a procedure with long-term benefit, and is not indicated for the lesser toes.Correct Answer: Arthrodesis of the hallux MP joint and resection of the lesser metatarsal heads

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1108. (406) Q3-539:

A 20-year-old collegiate football player sustains an injury to his big toe during a scrimmage game. He was pushing off when another player fell on his foot, resulting in the hallux being hyperextended. Two days later he has pain and swelling in the joint, limited motion, and normal radiographs. The recommended treatment is:

1) Ultrasound, whirlpool, and joint mobilization
3) Rest, compression, toe taping, and gradual rehabilitation
2) Short leg cast or boot for 4 weeks
5) Active toe exercises and resumption of activities to prevent joint stiffness
4) Joint injection of corticosteroid and lidocaine

This is a typical turf toe injury caused by hyperextension of the hallux, and injury to the plantar plate. This injury may result in marked disability if not correctly treated, and the joint must be rested, although cast and boot immobilization is not necessary. Injection is not indicated, and taping of the toe will alleviate pain and permit ambulation.Correct Answer: Rest, compression, toe taping, and gradual rehabilitation

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1109. (1391) Q3-1762:

A 43-year-old patient presents with pain in the hallux metatarsophalangeal (MP) joint. Motion is limited in dorsiflexion and to some extent in plantarflexion, and mild arthritis is radiographically evident. If a cheilectomy is performed on this patient, what is the primary goal of the procedure in the management of hallux rigidus:

1) To increase the range of motion of the MP joint
3) To decrease the impingement on the terminal branch of the deep peroneal nerve
2) To remove the osteophytes from the medial and lateral surface of the metatarsal head
5) To decrease the likelihood of a subsequent arthrodesis of the MP joint
4) To decrease pain

The goal of cheilectomy is to decrease pain. Although motion may increase, this must not be the goal of surgery because the motion may only be minimally increased. Some patients improve motion markedly after cheilectomy, but this should not be the focus of treatment or promised to the patient.Correct Answer: To decrease pain

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1110. (1392) Q3-1763:

The most common complication after resection of a plantar fibromatosis is:

1) A recurrent fibroma
3) Wound dehiscence
2) Infection
5) Injury to the lateral plantar nerve
4) Injury to the medial plantar nerve

The most common complication after resection of plantar fibromatosis is recurrence. Although other complications (nerve injury and wound dehiscence) do occur, they occur less frequently. The most reliable treatment for plantar fibromatosis is observation and shoe wear modification if the lesion is painful.Correct Answer: A recurrent fibroma

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1111. (1393) Q3-1764:

A 24-year-old man presents for treatment of a painful fifth toe deformity. He had the deformity for 10 years and notes that it is getting progressively worse. On examination, a claw toe deformity is present. There is 90Â° of fixed hyperextension of the metatarsophalangeal joint, 70Â° of flexion at the interphalangeal joint, and a painful corn on the distal tip of the phalanx. The patient would like surgical correction. Which procedure is most likely to give him relief of pain and correction of deformity:

1) Flexor tenotomy and extensor tenotomy
3) Proximal interphalangeal (PIP) joint resection arthroplasty
2) Dorsal capsulectomy, extensor lengthening, and flexor tenotomy
5) Subtotal proximal phalangectomy with tendon transfer
4) PIP joint arthrodesis

Correction of a fixed claw fifth toe deformity is not an easy procedure. The customary procedures used for correction of other lesser toe deformities are not always successful. In this patient, PIP arthroplasty or arthrodesis alone will not correct this deformity. The deformity requires a subtotal or complete proximal phalangectomy. Although this procedure corrects the deformity, patients must know that they will inevitably have a floppy fifth toe.Correct Answer: Subtotal proximal phalangectomy with tendon transfer

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1112. (1394) Q3-1765:

A 22-year-old collegiate basketball player presents for treatment of a stress fracture of the base of the fifth metatarsal at the junction of the metaphysis and diaphysis. The fracture was treated operatively, and the patient returned to playing basketball. Three months later, it was apparent that a repeat fracture was present. The fracture was treated with screw removal and a repeat screw fixation. Four months later, after a successful basketball season, he sustained a repeat stress fracture of the metatarsal. On examination, he has a mild cavovarus foot configuration with normal ankle range of motion. Inversion is 15Â° and eversion is 5Â°. The base of the fifth metatarsal is prominent. The most likely cause for the repeat fracture is:

1) Abnormal ankle biomechanics
3) A varus heel
2) Chronic unrecognized ankle instability
5) Chronic avascularity of the fifth metatarsal base
4) Bone sclerosis of the fifth metatarsal base

The most common cause of recurrent injury to the fifth metatarsal is unrecognized varus heel deformity. Surgeons must also check for ankle instability, which may be present in this patient. A varus heel, ankle instability, and injury to the fifth metatarsal are associated with recurrent deformity.Correct Answer: A varus heel

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1113. (1395) Q3-1766:

Which statement regarding the peroneal tendon(s) is incorrect:

1) The peroneus longus tendon attaches to the first metatarsal.
3) The peroneus brevis tendon has muscle attached to the tendon at a level lower than the peroneus longus tendon.
2) The peroneus brevis tendon is a plantarflexor of the ankle.
5) There are two separate retinacular sheaths for the peroneal tendons distal to the tip of the fibula.
4) The peroneus longus tendon lies anterior to the peroneus brevis tendon at the level of the distal fibula.

The peroneus brevis tendon plantarflexes and everts the foot and ankle. The peroneus longus tendon plantarflexes the foot, is a mild evertor of the foot, and plantarflexes the first metatarsal. The peroneus brevis tendon is prone to tears or splits at the level of the distal fibula and lies anterior to the peroneus longus tendon at this level.Correct Answer: The peroneus longus tendon lies anterior to the peroneus brevis tendon at the level of the distal fibula.

1114. (1396) Q3-1767:

A 41-year-old patient presents for treatment of a joint depression calcaneus fracture. A Sanders type IIA fracture is visible on a computerized tomography scan. After appropriate counseling, the patient elects nonoperative treatment. What is the most common complication of this injury that may subsequently occur in this patient:

1) Peroneal tendon dislocation
3) Calcaneofibular impingement pain
2) Achilles tendonitis
5) Tarsal tunnel syndrome
4) Subtalar arthritis

Subtalar arthritis occurs when a calcaneus fracture is treated nonoperatively; however, impingement of the fibula against the widened calcaneus will more frequently cause symptoms. Soft tissue problems, including tarsal tunnel syndrome, peroneal tendonitis, and sural neuritis, occur less frequently.Correct Answer: Calcaneofibular impingement pain

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1115. (1397) Q3-1768:

A patient presents for treatment of a painful ankle 2 years after a hindfoot injury. He was treated nonsurgically for a calcaneus fracture that occurred when he fell. His symptoms include anterior ankle pain, weakness during pushing off, and pain along the lateral aspect of the hindfoot. On examination, he has pain to palpation at the tip of the fibula, absent inversion and eversion, 20Â° of plantarflexion, and no dorsiflexion. Plantarflexion strength appears adequate, and there is no compromise of the forefoot flexor function. The recommended surgical procedure is:

1) Anterior ankle cheilectomy and lateral calcaneus ostectomy
3) In situ subtalar arthrodesis and lateral calcaneus ostectomy
2) Anterior ankle cheilectomy and subtalar arthrodesis
5) Triple arthrodesis and Achilles tendon lengthening
4) Subtalar bone block distraction arthrodesis and lateral calcaneus ostectomy

This patient sustained a joint depression calcaneus fracture with a loss of the talar declination angle. He has limited dorsiflexion that is characteristic of a negative talar declination angle. This decreases the fulcrum of the Achilles tendon and weakens pushoff strength. An in situ subtalar arthrodesis may correct the subtalar joint pain but will not address the decreased height of the hindfoot and the negative talar declination angle. The negative talar declination angle can only be corrected by inserting a tricortical bone graft into the subtalar joint.Correct Answer: Subtalar bone block distraction arthrodesis and lateral calcaneus ostectomy

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1116. (1398) Q3-1769:

A patient presents for treatment of painful toes 1 year after open reduction and internal fixation of a calcaneus fracture. He notes difficulty with shoe wear and pain on ambulation. On examination, there are fixed claw toe deformities of the second, third, and fourth toes that are painful. The most likely cause of the toe deformities is:

1) Entrapment of the medial plantar nerve
3) Tethering of the flexor hallucis longus under the sustentaculum tali
2) Flexor digitorum longus stenosis associated with entrapment in the deep muscle layer of the foot
5) Unrecognized compartment syndrome of the foot
4) Unrecognized injury to the forefoot at the time of the original calcaneus fracture

Claw toe deformities after calcaneus fracture occur as a result of untreated compartment syndrome. Compartment syndrome occurs as a result of intrinsic muscle atrophy or fibrosis of the short flexor muscles followed by fixed toe deformity.Correct Answer: Unrecognized compartment syndrome of the foot

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1117. (1399) Q3-1770:

Slide 1

A 56-year-old patient sustained an ankle fracture 3 years ago that was treated with closed reduction and cast immobilization. Since the injury, she has experienced pain upon ambulation and ankle stiffness. On examination, the range of motion of the ankle is 5Â° of dorsiflexion and 30Â° of plantarflexion. Crepitus with motion is not present, but the patient does experience severe pain. A radiograph is presented (Slide). The recommended procedure to alleviate the patientâs pain and improve function is:

1) Total ankle replacement
3) Ankle arthroscopy and joint debridement
2) Ankle arthrodesis
5) Anterior ankle cheilectomy, Achilles lengthening, and joint debridement
4) Osteotomy of the fibula

The arthritis in this joint is not severe, but there is joint malalignment associated with a short and externally rotated fibula. Joint malalignment is correctable with a lengthening and rotational (internal) osteotomy of the fibula with bone graft. Joint debridement, either open or arthroscopic, is not effective in the management of posttraumatic ankle arthritis. Arthrodesis and arthroplasty are not necessary at this stage.Correct Answer: Osteotomy of the fibula

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1118. (1400) Q3-1771:

Slide 1

A 43-year-old construction worker presents for treatment of ankle pain. The patient recounts a fall from a height that caused an ankle fracture 2 years ago. The fracture was treated with closed reduction and cast immobilization for 5 months. He experiences pain upon ambulation and is unable to work. On examination, the range of ankle motion is 5Â° dorsiflexion and 20Â° plantarflexion. There is no crepitus with motion, but severe pain is present. A radiograph is presented (Slide 1). The recommended procedure to alleviate pain and improve function is:

1) Total ankle replacement
3) Arthroscopy ankle and joint debridement
2) Ankle arthrodesis
5) Anterior ankle cheilectomy, Achilles lengthening, and joint debridement
4) Osteotomy of the tibia and fibula

The arthritis in this joint is not severe, but there is joint malalignment associated with a short and externally rotated fibula and a marked valgus tibiotalar deformity. Although arthrodesis or total ankle replacement may be considered as treatment for some patients, this patient is not a good candidate for these procedures because he does not have severe arthritis. The deformity must be corrected with an osteotomy of the tibia and fibula. Although an opening wedge osteotomy may be considered, a closing wedge procedure is easier to perform and has a higher rate of healing.Correct Answer: Osteotomy of the tibia and fibula

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1119. (1401) Q3-1772:

Slide 1

A 29-year-old patient has had pain in her foot for 1 year. She twisted her ankle and was treated for a sprain with a brace and therapy. She has persistent pain in her foot and pain on ambulation. On examination, slight pes planus is present, pain is noted on manipulation of the foot, and there is tenderness in the midfoot and hindfoot. A radiograph is presented (Slide). The most likely cause of the pain is:

1) A tear of the posterior tibial tendon
3) A tear of the short plantar ligament
2) A tear of the spring ligament
5) A tear of the metatarsocuneiform ligament
4) A tear of the deltoid ligament

Slight abduction of the tarsometatarsal joints is noted, along with arthritis of the medial and middle columns of the midfoot. This likely resulted from a tear of the ligament between the base of the second metatarsal and the medial cuneiform (Lisfranc ligament).Correct Answer: A tear of the metatarsocuneiform ligament

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1120. (1402) Q3-1773:

Slide 1 **Slide 2**

A 53-year-old man presents with a swollen foot. He does not recall any injury to the foot, and he has minimal pain. He does not have any pertinent medical history. The clinical and radiographic appearance of the foot is presented (Slide 1 and Slide 2). Based upon the information, the recommended treatment of this injury is:

1) Open reduction and internal fixation (ORIF)
3) Open reduction and primary arthrodesis
2) No weight bearing and immobilization in a removable boot
5) Debridement of the foot, deep tissue cultures, and organism-specific intravenous antibiotics
4) Hospitalization, bedrest, and intravenous antibiotics

Patients with neuropathy may present for the first time with a neuropathic dislocation (Charcot neuroarthropathy) even before the cause of the neuropathy is diagnosed. The recommended treatment of an acute neuropathic midfoot dislocation is open reduction and primary arthrodesis. Although ORIF without arthrodesis may be considered, recurrent deformity frequently occurs.Correct Answer: Open reduction and primary arthrodesis

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1121. (1403) Q3-1774:

Slide 1

A 49-year-old woman has had swelling in the posterior aspect of the ankle for 5 years (Slide). The pain is focal and does not radiate. She notes that pain is worse with activity, exercise, and shoe wear. Which of the following is not an acceptable treatment for this patient:

1) Short leg cast immobilization
3) Debridement of the insertion of the Achilles tendon
2) High heel shoe with no heel counter
5) Achilles stretching exercises and physical therapy modalities including corticosteroid application
4) Osteotomy of the calcaneus

Insertional Achilles tendinopathy is aggravated by a hard heel counter on the shoe, a flat shoe, or exercise without stretching. Therapy modalities are effective for treatment of this condition. If patients do not respond to nonoperative measures, then surgery with debridement of the Achilles tendon and posterior calcaneus may be required. Osteotomy of the calcaneus (as opposed to ostectomy) is not an effective treatment.Correct Answer: Osteotomy of the calcaneus

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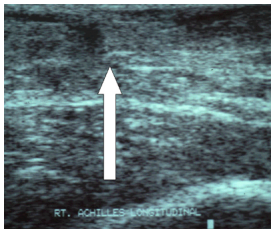
1122. (1404) Q3-1775:



Slide 1

This slide (the arrow is pointing in the direction of the pathology) illustrates which of the following conditions of the Achilles tendon:

1) Chronic degenerative tendinosis
3) Acute inflammatory tendinopathy
2) Acute paratendinitis
5) Chronic myxoid degeneration
4) Acute tendon rupture

This ultrasound is a longitudinal section of the Achilles tendon demonstrating acute rupture. Note the defect in continuity of the tendon below the skin surface. No tendon defects are noted in paratendinitis and tendinosis.Correct Answer: Acute tendon rupture

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1123. (1405) Q3-1776:

Which of the statements regarding paratendinitis of the Achilles tendon is true:

1) Paratendinitis of the Achilles tendon is commonly associated with racket sports.
3) Paratendinitis of the Achilles tendon is effectively treated with Achilles stretching and orthoses.
2) Paratendinitis of the Achilles tendon is common in patients who have a cavus foot.
5) Paratendinitis of the Achilles tendon leads to chronic rupture of the tendon.
4) Paratendinitis of the Achilles tendon is associated with tendon degeneration.

Paratendinitis of the Achilles tendon is commonly associated with runners who hyperpronate. Paratendinitis of the Achilles tendon is amenable to stretching, physical therapy treatments, and an orthotic support that controls rapid pronation during the flat foot phase of gait. Although the condition can become chronic and require surgery, it does not lead to or predispose to a degenerative rupture.Correct Answer: Paratendinitis of the Achilles tendon is effectively treated with Achilles stretching and orthoses.

1124. (1406) Q3-1777:

A 65-year-old woman presents for treatment of a painful flatfoot condition. On examination, the hindfoot is in marked valgus and a rupture of the posterior tibial tendon is noted. The recommended treatment is a transfer of the flexor digitorum longus tendon and a medial translational osteotomy of the calcaneus. The rationale for the osteotomy includes all of the following except:

1) To increase the ground reaction forces medially
3) To improve the weight bearing tripod effect of the foot
2) To make the Achilles tendon vector lateral to the axis of the subtalar joint
5) To decrease the valgus force of the gastrocnemius on the hindfoot
4) To augment the flexor transfer medially

A medial translational osteotomy of the calcaneus shifts the axis of the Achilles tendon insertion medial to the axis of the subtalar joint. In doing so, the lateralizing force of the gastrocnemius on the heel is lessened and the medial tendon shift augments the strength of the flexor digitorum longus transfer and improves the mechanical efficiency of the foot by altering the ground reaction forces.Correct Answer: To make the Achilles tendon vector lateral to the axis of the subtalar joint

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1125. (1407) Q3-1778:

Which of the following muscles has the largest cross-sectional diameter:

1) Flexor hallucis longus
3) Peroneus longus
2) Flexor digitorum longus
5) Extensor digitorum longus
4) Peroneus brevis

Following the muscles of the gastrocnemius soleus muscle group, the flexor hallucis longus is the most powerful flexor of the ankle. The flexor hallucis longus is almost twice as strong as the flexor digitorum longus. These are important factors when planning tendon transfers in the foot and ankle.Correct Answer: Flexor hallucis longus

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1126. (1408) Q3-1779:

After surgery to the hallux, a patient complains of burning and numbness along the medial aspect of the first metatarsal. The numbness extends from the medial cuneiform distally to the midportion of the first metatarsal and junction of the plantar and dorsal skin. The nerve involved with the pain is the:

1) Intermediate dorsal cutaneous branch superficial peroneal
3) Medial cutaneous branch superficial peroneal
2) Medial cutaneous branch deep peroneal
5) Intermediate cutaneous branch deep peroneal
4) Dorsal cutaneous branch medial plantar

The branches of the various sensory nerves of the foot are important to understand. The normal and aberrant topographic anatomy is important in any foot surgery, and management of posttraumatic neuritis is contingent upon an understanding of the anatomy.Correct Answer: Medial cutaneous branch superficial peroneal

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1127. (1409) Q3-1780:

The most common complication after resection arthroplasty (Keller) of the base of the hallucal proximal phalanx for correction of hallux valgus is:

1) Recurrent hallux valgus
3) Stiffness of the hallux metatarsophalangeal joint
2) Hallux varus
5) Stress fracture of the second metatarsal
4) Cock-up deformity of the hallux

Resection of the base of the hallucal proximal phalanx detaches the volar plate and the medial and lateral head of the flexor brevis tendon. This leads to weakening of plantarflexion strength and dorsal contracture. The weakness may also lead to lateral overload, metatarsalgia, and stress fracture.Correct Answer: Cock-up deformity of the hallux

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1128. (1410) Q3-1781:

A patient sustains a fracture of the anterior process of the calcaneus. What ligament is responsible for avulsion of this bone:

1) Short plantar
3) Anterior talofibular
2) Long plantar
5) Bifurcate
4) Calcaneofibular

The bifurcate ligament extends from the anterior process of the calcaneus to the cuboid and navicular. In certain plantarflexion and inversion injuries of the hindfoot, the ligament, which is strong, will avulse the anterior process of the calcaneus.Correct Answer: Bifurcate

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1129. (1411) Q3-1783:

Slide 1

The ball and socket ankle deformity shown (Slide) is associated with all of the following except:

1) A short femur
3) A talocalcaneal fusion
2) A short fibula
5) Missing lateral rays of the foot
4) Cavovarus

A ball and socket ankle deformity is caused by limited motion of the peritalar joints, particularly the subtalar and talonavicular joints, during childhood. For example, a talonavicular coalition limits inversion and eversion, and the tibiotalar joint compensates for this loss by increasing motion in the horizontal plane. As motion is increased in the horizontal plane, the medial and lateral edges of the tibiotalar articulation round off and the ball and socket joint develops.Correct Answer: Cavovarus

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1130. (1412) Q3-1784:

A patient wants a below the knee amputation. As an alternative, you recommend a Syme amputation. What is the most relevant factor that would contraindicate performing a Syme amputation:

1) A metastatic tumor to the forefoot
3) A primary tumor in the forefoot and midfoot
2) Severe infection in the foot
5) Trauma to the hindfoot
4) Peripheral vascular disease

Although the Syme amputation was once popular because it allowed patients to ambulate for short distances (e.g., around their house) without using a prosthesis, surgeons now perform more below the knee amputations because of newer prosthetic designs. The Syme procedure still remains in our surgical armamentarium.

The only factor listed in the answer choices that may preclude amputation at this level is peripheral vascular disease. A more important factor that would contraindicate performing a Syme amputation is perfusion to the heel pad.Correct Answer: Peripheral vascular disease

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1131. (1413) Q3-1786:

Which of the following statements regarding a fracture of the junction of the proximal metaphyseal and diaphyseal portion of the fifth metatarsal is false:

1) A fracture of the junction of the proximal metaphyseal and diaphyseal portion of the fifth metatarsal is the least likely of all fifth metatarsal fractures to heal.
3) The mechanism of injury is forced abduction.
2) Fractures treated nonoperatively heal from medial to lateral on serial radiographs.
5) Up to one-third of patients treated with casting may refracture in long-term follow-up.
4) Radiographic evidence of union lags behind clinical healing examination.

The fracture of the junction of the proximal metaphyseal and diaphyseal portion of the fifth metatarsal, otherwise known as the Jones fracture, causes complications with bone healing. The fracture is caused by a plantarflexion inversion twist of the foot and ankle and needs prompt treatment because nonunion rates are high with this type of fracture.Correct Answer: The mechanism of injury is forced abduction.

1132. (1414) Q3-1787:

A foot is maximally dorsiflexed during this point of the gait cycle:

1) Midswing
3) Toe off
2) Midstance
5) First one-third of stance
4) Heelstrike

During gait, a foot is dorsiflexed during midswing and foot flat. During midswing, the anterior tibial muscle maintains the foot in a dorsiflexed position to facilitate a smooth heelstrike. This is an active dorsiflexion of the foot and ankle. The maximum dorsiflexion of the foot, however, is passive and occurs as the leg moves forward over the foot during foot flat at midstance.Correct Answer: Midstance

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1133. (1415) Q3-1788:

Which of the following structures is disrupted in patients with an acute medial subtalar dislocation:

1) Lisfranc ligament
3) Talocalcaneal ligament
2) Long plantar ligament
5) Anterior talofibular ligament
4) Calcaneonavicular ligament

As the foot and the subtalar joint move medially, the subtalar ligaments and the ligaments on the lateral aspect of the ankle are disrupted. The talocalcaneal, or interosseous, ligament is the only ligament that is vulnerable in an acute medial subtalar dislocation.Correct Answer: Talocalcaneal ligament

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1134. (1416) Q3-1791:

An 8-year-old soccer player has had bilateral heel pain for 3 months. He has no constitutional complaints. Isolated tenderness to the posterior aspect of his calcaneal tuberosity is present. Recommended treatment is:

1) Bone scan to rule out infectious and/or malignant conditions
3) A short leg cast
2) Magnetic resonance image to assess for signs of calcaneal avascular necrosis
5) Achilles tendon stretching
4) Computerized tomography scan to rule out osseous abnormality and/or coalition

Posterior heel pain in a child is common. This scenario describes an apophysitis of the insertion of the Achilles tendon, referred to as Severâs disease. The condition is self-limited and responds well to stretching of the Achilles tendon, temporary limitation of activities, and ice applied to the heel after exercise.Correct Answer: Achilles tendon stretching

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1135. (1417) Q3-1792:

A 26-year-old recreational volleyball player presents with complaints of recurrent right ankle instability. She has undergone 3 months of peroneal strengthening and proprioceptive training without success. She has tried and failed ankle bracing. She has a positive anterior drawer finding on examination, and her hindfoot is in neutral alignment. The recommended surgical plan is:

1) Transfer half of the peroneus brevis tendon obliquely through the fibula to recreate the vector of the anterior talofibular and calcaneofibular ligaments
3) Calcaneal osteotomy with reconstruction of the anterior talofibular and calcaneofibular ligaments
2) Reconstruction of the anterior talofibular and calcaneofibular ligaments with imbrication and advancement of the extensor retinaculum
5) Ankle ligament reconstruction with additional attention to the osteochondral talar dome injury
4) Allograft ligament reconstruction

In an athlete, unless there are unusual anatomic and physical findings, the appropriate ankle reconstruction is an anatomic repair of the ligaments as originally described by Brostrum. Procedures that use the peroneal tendon or tendon grafts should be used in circumstances when a high demand is put on the ankle (e.g., if the patient is heavy or if generalized ligamentous laxity is present).Correct Answer: Reconstruction of the anterior talofibular and calcaneofibular ligaments with imbrication and advancement of the extensor retinaculum

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1136. (1418) Q3-1793:

A 65-year-old woman presents with pain along the posteromedial aspect of her right ankle. She has a clinical deformity of her foot with loss of normal arch height. Her hindfoot is in valgus but is passively correctable to neutral. She has weakness with inversion and cannot perform a single stance heel raise. She has not had any form of treatment. Recommended treatment includes:

1) Debridement of posterior tibial tendon
3) A molded ankle orthosis
2) Transfer of the flexor digitorum longus tendon and medial displacement calcaneal osteotomy
5) Lateral column lengthening with flexor digitorum longus tendon transfer
4) Corticosteroid injection of posterior tibial tendon sheath

Although there is the likelihood that this patient may ultimately require surgery, the nonoperative management of posterior tibial tendon rupture is important. The success rate of bracing is variable, but bracing must be used as the first line of treatment for a patient as described above.Correct Answer: A molded ankle orthosis

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1137. (1419) Q3-1794:

After counseling a 22-year-old patient who is scheduled to undergo a triple arthrodesis, he wants to know the risk that he will develop ankle arthritis. You tell him:

1) The risk of developing ankle arthritis after a triple arthrodesis is unknown.
3) 100% at 5 years
2) Ankle arthritis does not occur following triple arthrodesis.
5) 50% at 5 years
4) 25% at 5 years

Ankle arthritis commonly occurs following a triple arthrodesis. In a recent study by Pell and colleagues, the incidence of ankle arthritis in 134 patients who underwent a triple arthrodesis with a 5.6-year mean follow-up was 53%. Although not all of these patients are symptomatic, this is a problem.Correct Answer: 50% at 5 years

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1138. (1420) Q3-1795:

A 57-year-old woman presents for treatment of a painful flatfoot deformity. She says that her foot has been painful for 4 years, but she does not recall any injury to the foot. The opposite foot is not bothersome. Upon examination, she has pain in the midfoot and hindfoot. Resisted inversion is strong and painful. She is able to perform a single and repetitive heel rise test. The most likely diagnosis is:

1) An unrecognized Lisfranc injury
3) Rupture of the spring ligament
2) Posterior tibial tendon rupture
5) Calcaneonavicular tarsal coalition
4) Idiopathic tarsometatarsal arthritis

Osteoarthritis of the tarsometatarsal joints in the adult is common. Patients are usually 50 to 60 years old, and the condition typically presents with pain in the midfoot and becomes progressively worse over time. The posterior tibial tendon is not torn, but as the foot becomes flatter and the forefoot more abducted there may be secondary stretching or tearing of the posterior tibial tendon.Correct Answer: Idiopathic tarsometatarsal arthritis

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1139. (1421) Q3-1796:

Which clinical examination is likely to confirm a suspected rupture of the posterior tibial tendon:

1) Active plantarflexion of the foot against resistance
3) Resisted active inversion of the foot when the foot is positioned in abduction
2) Combined active plantarflexion and inversion of the foot against resistance
5) The presence of forefoot abduction upon standing and inability to adduct the foot
4) Ability to perform a single heel rise test

The anterior tibial tendon can compensate for a weak posterior tibial tendon. The primary function of the anterior tibial tendon is dorsiflexion, although the tendon may also invert the foot, particularly against resistance in the presence of a ruptured posterior tibial tendon. To prevent the anterior tibial tendon from inverting the foot, position the foot in plantarflexion and abduction to begin with when testing resistance to inversion.Correct Answer: Resisted active inversion of the foot when the foot is positioned in abduction

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1140. (1422) Q3-1797:

The most reliable indication of an interdigital neuroma in the second web space is:

1) Pain upon compression of the web space
3) Absent sensation between the second and third toes
2) A painful click in the web space when compressing the forefoot
5) A neuroma of the second web space visible on magnetic resonance image
4) Burning, tingling, and numbness of the third toe

A click when compressing the forefoot (referred to as a positive Mulder sign) is not diagnostic of a neuroma and is present due to an enlarged intermetatarsal bursa. The sensation of pain and burning is varied, and some patients report only a vague numbness. Magnetic resonance imaging can have a false positive and false negative result; therefore, it must not be relied upon for diagnosis. The most reliable finding on physical examination is pain on compression of the affected web space.Correct Answer: Pain upon compression of the web space

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1141. (1423) Q3-1798:

A 68-year-old patient presents for evaluation of ankle pain. He is unable to walk more than 10 minutes without pain and stiffness. He has been treated with anti-inflammatory medication, intra-articular injection of steroid, and an ankle foot orthosis. He has 35Â° of clinical motion associated with crepitus and pain and there is no motion in the subtalar joint. Radiographs demonstrate large osteophytes in the anterior ankle, no joint space, and mild osteophytes of the talonavicular joint. The recommended surgical treatment is:

1) Anterior ankle cheilectomy
3) Ankle arthrodesis
2) Ankle arthroscopy
5) Total ankle replacement
4) Tibiotalocalcaneal arthrodesis

A patient with good range of motion of the ankle associated with poor subtalar motion and ankle arthritis is a candidate for a total ankle replacement. Although ankle arthrodesis may be considered, in the presence of a stiff subtalar joint, osteophytes of the talonavicular joint, and good ankle motion, this procedure is likely to lead to a high incidence of peritalar arthritis and pain.Correct Answer: Total ankle replacement

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1142. (1424) Q3-1799:

A 21-year-old recreational athlete presents for treatment of ankle weakness. She notes that she trips frequently, that the ankle feels unstable, particularly on uneven ground surfaces, and that she has experienced frequent sprains. On examination, the ankle appears to be unstable and radiographs demonstrate no instability on stress testing. The most likely diagnosis is:

1) Generalized ligamentous laxity
3) Tear of the calcaneofibular ligament
2) Tear of the anterior talofibular ligament
5) Tear of the anterior talofibular and calcaneofibular
4) Tear of the talocalcaneal interosseous ligament

This patient has subtalar instability. When there is no instability demonstrated on radiographic stress testing despite a history of recurrent ankle sprains, the subtalar joint must be assessed.Correct Answer: Tear of the talocalcaneal interosseous ligament

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1143. (1425) Q3-1800:

The symptoms of a tarsal tunnel syndrome may become aggravated by:

1) Pronation of the foot
3) Dorsiflexion of the ankle
2) Plantarflexion of the foot
5) Rotation of the ankle
4) Inversion of the foot

Pronation of the foot places increased stretch on the tibial nerve. This motion has important implications for treatment because the pronated flatfoot should be supported with an orthotic arch support in patients with symptoms of a tarsal tunnel syndrome.Correct Answer: Pronation of the foot

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1144. (1426) Q3-1801:

A 56-year-old woman presents for evaluation and treatment of a painful hallux. She notes the pain over the dorsal surface of the hallux metatarsophalangeal (MP) joint and on the plantar aspect of the hallux interphalangeal (IP) joint. Clinically, there is no range of motion in dorsiflexion of the hallux MP joint, pain upon attempted movement of the MP joint, and 20Â° of extension of the hallux IP joint. Radiographs demonstrate arthritis of the hallux MP joint and normal alignment of the first metatarsal. The surgical procedure that is likely to cause further mechanical problems for this patient is:

1) Resection arthroplasty of the hallux MP joint
3) Interposition arthroplasty of the hallux MP joint
2) Cheilectomy of the hallux MP joint
5) Plantarflexion osteotomy of the first metatarsal
4) Arthrodesis of the hallux MP joint

This patient has end stage arthritis and rigidus of the hallux MP joint. Hyperextension of the IP joint is already present. If arthrodesis of the MP joint were performed, then further load and instability of the IP joint would occur.Correct Answer: Arthrodesis of the hallux MP joint

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1145. (1427) Q3-1802:

Slide 1 **Slide 2**

A 38-year-old woman presents for evaluation of painful hallux rigidus. Her clinical and radiographic images are shown (Slide 1 and Slide 2). Based upon her presentation, what is the likelihood that first metatarsus elevatus is responsible for her clinical condition:

1) Rare
3) 50%
2) 25%
5) 100%
4) 75%

Surgeons cannot assume that an elevated first metatarsal is responsible for causing hallux rigidus. On a lateral radiograph, there may be notable elevation of the first metatarsal (as present in this patient), but the elevation may be a secondary result of the limited motion of the hallux metatarsophalangeal joint. Studies have demonstrated that there is no difference in the elevation of the first metatatarsal in patients with hallux rigidus.Correct Answer: Rare

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1146. (1428) Q3-1803:

Slide 1 **Slide 2**

The patient shown in Slide 1 and Slide 2 underwent surgical correction of painful hallux rigidus. The purpose of the procedure on the hallux was:

1) To increase the range of motion of the hallux metatarsophalangeal (MP) joint
3) To depress the hallux and improve push off strength
2) To elevate the hallux off the ground
5) To change the kinematics of the hallux MP joint, thereby decreasing the likelihood of recurrent deformity
4) To decrease the jamming of the hallux MP joint on push off

The osteotomy of the proximal phalanx of the hallux (the Moberg osteotomy) is designed to elevate the hallux off the ground. The procedure does not improve the range of motion of the MP joint, but it increases the available motion of the hallux in toe off.Correct Answer: To elevate the hallux off the ground

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1147. (1429) Q3-1804:

Of the proximal first metatarsal osteotomies listed below, which has the least stability for dorsiflexion load:

1) Ludloff osteotomy
3) Scarf osteotomy
2) Crescentic osteotomy
5) Closing wedge osteotomy
4) Chevron osteotomy

The crescentic osteotomy is inferior on mechanical testing to the other proximal first metatarsal osteotomies. This must be considered when planning correction of deformity associated with hallux valgus, particularly in a patient with osteopenia.Correct Answer: Crescentic osteotomy

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1148. (1430) Q3-1805:

A 54-year-old patient presents for correction of painful hallux valgus. She has a prominent medial eminence, pain on pressure over the metatarsophalangeal (MP) joint, increased elevation of the first metatarsal, and painful callosity under the second metatarsal. The recommended procedure is:

1) Arthrodesis of the hallux MP joint
3) Distal metatarsal osteotomy and distal soft tissue release
2) Proximal first metatarsal osteotomy and distal soft tissue release
5) Proximal first metatarsal osteotomy, distal soft tissue release, and condylectomy of the second metatarsal head
4) Arthrodesis of the metatarsocuneiform joint

This patient has typical findings of hypermobility of the first metatarsal. The increased pressure under the second metatarsal head may be the result of elevation of the first metatarsal or dysfunction of the windlass mechanism that depresses the first metatarsal upon toe off. Hypermobility of the first ray associated with hallux valgus is successfully treated with arthrodesis of the metatarsocuneiform joint or the modified Lapidus procedure.Correct Answer: Arthrodesis of the metatarsocuneiform joint

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1149. (1431) Q3-1807:

Slide 1 **Slide 2**

This patient was treated for metatarsalgia with an oblique osteotomy of the metatarsal head and neck (Weil osteotomy). Although the symptoms of metatarsalgia dissipated, she has continued complaints about the position of the toe (Slide 1 and Slide 2). This complication is a result of which of the following anatomic deformities:

1) Subluxation of the metatarsophalangeal (MP) joint
3) Dorsal shift of the interosseous tendon
2) Tearing of the volar plate
5) Persistent contracture of the lumbrical tendons
4) Scarring in the skin and subcutaneous tissue

Following an oblique osteotomy of the metatarsal head and neck (Weil osteotomy), the interosseous tendons shift dorsal to the axis of the metatarsal head. Instead of functioning as strong plantarflexors of the MP joint, they may now function as dorsiflexors, leading to the elevation of the toe off the ground and dorsal contracture.Correct Answer: Dorsal shift of the interosseous tendon

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1150. (1432) Q3-1808:

The strongest plantarflexor of the metatarsophalangeal (MP) joint of the lesser toes is the:

1) Long flexor tendon
3) Lumbrical tendon
2) Volar plate
5) Interosseous tendon
4) Short flexor tendon

Although the short flexor tendon plantarflexes the MP joint of the lesser toes, the interosseous tendons are stronger. When intrinsic atrophy or dysfunction of the forefoot is present, an intrinsic minus deformity occurs. The long flexor tendon does not flex the MP joint.Correct Answer: Interosseous tendon

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1151. (1433) Q3-1810:

Which of the following procedures is not indicated as part of the reconstruction of the cavovarus hindfoot:

1) Anterior tibial tendon transfer to the middle cuneiform
3) Posterior tibial tendon transfer to the lateral cuneiform
2) Peroneus longus tendon to peroneus brevis tendon transfer
5) Posterior tibial tendon transfer to the peroneus brevis tendon
4) Extensor hallucis tendon transfer to the first metatarsal

All of the above tendon transfers may be used as part of a reconstruction of the cavus foot except the anterior tibial tendon. The imbalance between the anterior tibial tendon and the peroneus longus tendons are responsible for the cavovarus deformity.Correct Answer: Anterior tibial tendon transfer to the middle cuneiform

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1152. (1434) Q3-1811:

Transfer of the extensor hallucis longus tendon to the first metatarsal and arthrodesis of the hallux interphalangeal joint is indicated for which of the following deformities:

1) A 36-year-old patient with a cavus foot following a compartment syndrome
3) Correction of hallux varus deformity
2) A 20-year-old patient with a flexible cavovarus deformity
5) A 42-year-old patient with Charcot-Marie-Tooth disease and pes planovalgus deformity
4) Correction of a laceration of the extensor hallucis longus

Correction of the claw hallux and first metatarsal equinus deformity may be accomplished by transfer of the extensor hallucis longus tendon and arthrodesis of the hallux interphalangeal joint. Once the deformity of the forefoot is fixed (e.g., following a compartment syndrome), the extensor hallucis longus tendon can no longer dorsiflex the first metatarsal. Although Charcot-Marie-Tooth disease is often associated with a cavus foot, the transfer is not indicated when a planovalgus foot is present.Correct Answer: A 20-year-old patient with a flexible cavovarus deformity

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1153. (1435) Q3-1812:

A 43-year-old diabetic patient has had an ulcer on the plantar aspect of her foot for 9 months. She has no systemic symptoms. There is minimal drainage from the ulcer, and she has no pain in the foot. Initial management of this patient must include:

1) Culture and sensitivity of the ulcer with initiation of culture-specific antibiotic therapy
3) An indium scan to determine the presence of osteomyelitis
2) A technetium bone scan to determine the presence of osteomyelitis
5) Irrigation and debridement of the ulcer, deep tissue cultures, and appropriate antibiotic therapy
4) A total contact cast

This neuropathic ulcer is stable. There is minimal drainage and no clinical findings to suggest an active infection. Culture of the ulcer yields multiple nonpathogenic organisms and antibiotic therapy is not indicated. Treatment is initiated with either a total contact cast or a total contact walker boot.Correct Answer: A total contact cast

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1154. (1436) Q3-1813:

Slide 1

The primary cause for the deformity shown (Slide) is:

1) Malunion of the metatarsal osteotomy
3) Laceration of the flexor hallucis brevis tendon
2) Overplication of the medial capsule of the hallucis metatarsophalangeal joint
5) Fibular sesamoidectomy
4) Laceration of the flexor hallucis longus tendon

Overplication of the medial capsule, overcorrection of the metatarsal osteotomy, and excessive lateral soft tissue release can lead to a hallux varus deformity. The most likely cause, however, is interference with the varus-valgus balance of the hallux as a result of a fibular sesamoidectomy.Correct Answer: Fibular sesamoidectomy

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1155. (1437) Q3-1814:

Slide 1

A patient had a fixed deformity of the hallux interphalangeal (IP) joint (Slide) for 3 years following forefoot surgery. She complains of pain over the distal aspect of the hallux where rubbing occurs on the shoe. On examination, the hallux is flexible at the metatarsophalangeal (MP) and IP joints, there is no crepitus of the MP joint, and radiographs demonstrate normal alignment of the first metatarsal. The recommended procedure for correcting this deformity is:

1) Arthrodesis of the hallux MP joint
3) Transfer of the extensor hallucis brevis tendon
2) Resection arthroplasty of the hallux MP joint
5) Lengthening of the abductor hallucis and repair of the lateral capsule and the flexor hallucis brevis tendon with a bone suture anchor
4) Arthrodesis of the hallux IP joint with transfer of the flexor hallucis longus tendon

Arthrodesis and resection arthroplasty of the hallux MP joint are indicated in the presence of arthritis of the hallux MP joint. A tendon transfer is preferred, and the extensor hallucis brevis tendon is an effective transfer. Use of the extensor hallucis longus tendon with arthrodesis of the hallux IP joint is indicated when there is a fixed deformity of the hallux IP joint.Correct Answer: Transfer of the extensor hallucis brevis tendon

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1156. (1438) Q3-1815:

Slide 1

A 33-year-old recreational athlete presents for treatment of chronic ankle pain. He recalls multiple ankle sprains that occurred 10 years ago. He has not undergone any surgical treatment. On examination, his ankle is stable, there is no crepitus on range of motion, and pain is present to palpation of the posterior ankle. A computerized axial tomography is presented (Slide). The surgical procedure most consistent with a rapid recovery and predictable outcome is:

1) Ankle arthrodesis
3) Osteoarticular autograft procedure
2) Arthroscopy of the ankle with drilling of the osteochondral defect
5) Osteoarticular allograft procedure
4) Cartilage cell harvest with staged debridement of the talus and cartilage cell implantation

Ankle arthrodesis must be used as a salvage procedure for failed management of the osteochondral lesion of the talus. Although osteoarticular autograft is a popular procedure, the results are variable and unpredictable, particularly in posteromedial lesions. Ankle arthroscopy with transarticular drilling is the most predictable procedure with expected satisfactory results in approximately 80% of patients.Correct Answer: Arthroscopy of the ankle with drilling of the osteochondral defect

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1157. (1439) Q3-1816:

Slide 1

A 52-year-old man presents for treatment of acute pain in the forefoot. He notes that the onset of pain started 24 hours ago, and he is unable to walk. Examination of the hallux (Slide) is uncomfortable. The recommended treatment for this condition is:

1) Bed rest and intravenous antibiotic therapy
3) Immobilization of the foot in a short leg walking cast
2) Drainage of the hallux metatarsophalangeal joint, cultures, and initiation of a broad spectrum antibiotic
5) Intra-articular steroid injection
4) A wide comfortable shoe or sandal until the joint inflammation settles down

This patient presents with a classic acute gout attack. Although the hallux is in severe valgus, it is unlikely that this is the cause of the joint pain. Note the swelling of the hallux and the shiny skin from the acute inflammation. These clinical findings are typical of gout. Intra-articular injection of steroids is effective treatment and can be combined with oral anti-inflammatory agents.Correct Answer: Intra-articular steroid injection

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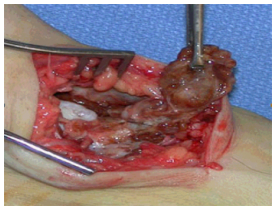
1158. (1440) Q3-1817:



Slide 1 **Slide 2**

A 43-year-old patient presents for treatment of a chronically painful ankle. He notes pain with ambulation, is unable to exercise, and has had marked swelling of the ankle for the last 6 months. When walking, he notes continued instability of the ankle. Examination of the ankle is unremarkable with the exception of swelling. A plain radiograph and intraoperative photograph are shown (Slide 1 and Slide 2). The most likely cause for this condition is:

1) Recurrent ankle sprain with proliferative synovitis
3) Early onset rheumatoid arthritis
2) Hemorrhagic synovitis
5) Synovitis associated with pseudogout
4) Pigmented villonodular synovitis

The appearance of the synovium is typical of pigmented villonodular synovitis. Staining of the synovium is characteristic. It is unlikely that a 43-year-old man will present with rheumatoid arthritis, although synovitis may appear similar. Recurrent ankle sprains cause a nonspecific synovitis that is not pigmented.Correct Answer: Pigmented villonodular synovitis

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1159. (1441) Q3-1818:

A patient sustains a crush injury when heavy farm equipment rolls over his foot. He presents to the emergency department 4 hours later with pain and swelling in the foot. Radiographic examination is normal. You examine him for a compartment syndrome. The intracompartmental pressure in the interosseous compartment is 20 mm Hg. The next phase of management may include all of the following except:

1) Examination under anesthesia followed by fasciotomy
3) Observation and repeat compartment pressure monitoring
2) Application of an intermittent foot pump device
5) Admission to hospital for elevation and management of pain with narcotics
4) Application of a bulky soft tissue dressing with a posterior plaster splint

Fasciotomy of the foot is not indicated when pressures are less than 20 mm Hg. All of the alternatives are reasonable forms of treatment including application of an intermittent foot pump device that has been demonstrated to decrease compartment pressures of the foot. If pressures were more than 30 mm Hg, then a fasciotomy may be indicated.Correct Answer: Examination under anesthesia followed by fasciotomy

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1160. (1442) Q3-1819:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 61-year-old woman presents for treatment of a painful ankle. She reports that 4 years ago, she sustained a fracture of her ankle that was treated with cast immobilization. She has experienced progressively worsening pain over the past 2 years. On examination, she has good range of motion of the ankle with crepitus and pain. Radiographs are presented (Slide 1 and Slide 2). All of the following are acceptable forms of surgical correction except:

1) Supramalleolar osteotomy of the tibia
3) Ankle arthrodesis
2) Ankle arthroscopy
5) Distraction lengthening osteotomy of the fibula
4) Total ankle replacement

Each of the alternatives presented is reasonable except for ankle arthroscopy because it has a limited role in the management of posttraumatic arthritis of the ankle. In this patient, there is a possibility to salvage the ankle before arthrodesis or joint replacement with an osteotomy of the tibia and or the fibula. Both have a definite role in management of ankle deformity and arthritis. A closing wedge osteotomy of the tibia was performed in this patient, and she remains asymptomatic 4 years later (Slide 3 and Slide 4).Correct Answer: Ankle arthroscopy

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1161. (1443) Q3-1820:

This patient developed a peripheral neuropathy of uncertain etiology. She has a partial peroneal nerve palsy with lack of extensor function of the hallux. She repeatedly stubs and catches the hallux when walking. Upon examination, she has good strength of the extensor digitorum longus tendon, as well as the anterior tibial tendon. Flexor strength of the foot is intact. All of the following are acceptable surgical alternatives except:

1) Arthrodesis of the hallux metatarsophalangeal (MP) joint
3) Tenodesis of the extensor hallucis longus tendon to the anterior tibial tendon
2) Tenodesis of the extensor hallucis longus tendon to the extensor digitorum longus tendon
5) Transfer of a portion of the extensor digitorum longus tendon to the extensor hallucis longus tendon
4) Transfer of the peroneus tertius tendon to the extensor hallucis longus tendon

When arthrodesis of the hallux MP joint is performed, it stabilizes the MP joint and continued flexion of the hallux with recurrent deformity occurs because the hallux interphalangel joint is not controlled with MP arthrodesis. All of the other procedures are satisfactory alternatives.Correct Answer: Arthrodesis of the hallux metatarsophalangeal (MP) joint

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1162. (2788) Q3-3286:

A 28-year-old professional athlete presents for treatment of foot pain following an inversion injury to her ankle. She has been immobilized in a short leg walker boot for 1 month with minimal relief of symptoms. On examination, pain is present in the sinus tarsi. The patientâs ankle is not painful or unstable. Radiographs demonstrate a calcaneonavicular coalition. Recommended treatment includes:

1) Corticosteroid and lidocaine injection into the sinus tarsi
3) Physical therapy treatments aimed at mobilizing the subtalar joint
2) Continued immobilization in a boot for an additional month
5) Excision of the tarsal coalition
4) Subtalar arthrodesis

When a tarsal coalition becomes symptomatic in an adult, surgery becomes necessary. Initial immobilization may be attempted, although prolonged immobilization in an athlete is not ideal. Manipulation of the foot will exacerbate the pain, and therapy is not indicated. If arthrodesis of the hindfoot is performed for treatment of a calcaneonavicular coalition, then a triple arthrodesis is performed. Excision of the adult calcaneonavicular coalition is the preferred treatment.Correct Answer: Excision of the tarsal coalition

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1163. (2789) Q3-3287:

A 43-year-old woman presents for treatment of pain in her forefoot that has been present for 1 year. The pain is localized to the second toe and radiates out to the tip of the toe with activities. When the patient wears high heel shoes, the pain is associated with numbness and burning of the toe. Your initial treatment consists of:

1) Excision of a third web space neuroma
3) Transfer of the flexor tendon to stabilize the metatarsophalangeal joint
2) Excision of a second web space neuroma
5) None of the above
4) Oblique metatarsal head osteotomy

This patient has typical symptoms of an interdigital neuroma, most likely involving the second web space. The likelihood of resolution of pain with nonsurgical treatment is good despite the duration of symptoms. Treatment can be initiated with a wide shoe, an orthotic arch support, or an injection of corticosteroid into the affected web space.Correct Answer: None of the above

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1164. (2790) Q3-3288:

A 62-year-old man presents for treatment of ankle pain. He suffered a fibular fracture 7 months ago while hiking in the mountains. He was treated with a short leg walking cast. On examination, he has pain on range of motion of the ankle, pain over the distal fibula, and no instability or crepitus to range of motion of the ankle. Pain is present on external rotation of the foot under the leg. Radiographs of the ankle demonstrate a healed fibular fracture with 7 mm of shortening and slight external rotation. There is a 7Â° valgus tilt of the tibiotalar joint and a widening of the medial clear space. The joint space laterally appears slightly narrowed. Recommended treatment includes:

1) Total ankle replacement
3) Lengthening osteotomy of the fibula
2) Ankle arthrodesis
5) Ankle arthroscopy
4) Deltoid ligament reconstruction

This patient has a malunion of the fibula that does not appear to be associated with ankle arthritis, despite the radiographic changes. The valgus tilt of the ankle joint is common with shortening of the fibula and does not imply arthritis. Therefore, arthrodesis and ankle replacement are not indicated. Lengthening osteotomy of the fibular combined with excision of the medial joint scar is ideal to realign the tibiotalar joint. Although ankle arthroscopy may be performed in conjunction with the fibular osteotomy, it is not sufficient treatment.Correct Answer: Lengthening osteotomy of the fibula

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1165. (2791) Q3-3289:

The most common complication following operative treatment of an acute rupture of the Achilles tendon is:

1) Wound infection
3) Re-rupture
2) Sural neuritis
5) Thickening of the tendon
4) Excessive dorsiflexion of the foot

Although all of the above complications may occur following repair of an acute Achilles rupture, improper tensioning of the repair and stretching of the repair occur most commonly.

This is due to a number of factors including the position of the foot during the repair, incorrect tensioning of the repair, and premature unprotected dorsiflexion of the foot following surgery. When suturing the tendon ends, the sutures must be inserted correctly and not into the frayed tendon ends, which will lead to incorrect tension on the repair. It is preferable to position the foot in slight equinus during the repair.

Correct Answer: Excessive dorsiflexion of the foot

1166. (2792) Q3-3290:

Slide 1

A 67-year-old obese patient presents for treatment of ankle pain. Twenty-five years ago, he underwent a total ankle replacement. He was asymptomatic for 15 years, and his symptoms have become intolerable. He has limited ankle motion, associated with pain in the ankle. His radiograph is presented (Slide). Which of the following is the preferred surgical procedure:

1) Revision total ankle replacement with graft and a larger prosthesis
3) Tibiotalocalcaneal arthrodesis
2) Ankle arthrodesis
5) Removal of the implant
4) Pantalar arthrodesis

Removal of the implant is necessary but will not be sufficient to alleviate pain from arthritis. In this obese patient, an arthrodesis is necessary. An extended hindfoot arthrodesis is only necessary when pain and arthritis are present in joints adjacent to the ankle. An ankle arthrodesis with interposition graft is sufficient.Correct Answer: Ankle arthrodesis

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1167. (2793) Q3-3291:

A 53-year-old woman presents for treatment of recurrent symptoms following excision of a third web space interdigital neuroma. She was asymptomatic for 6 months following surgery. On examination, pain is present in the third web space and reproduced with compression of the forefoot. The likelihood of a good result following revision surgery is:

1) 50%
3) 70%
2) 60%
5) 90%
4) 80%

The reported results following revision surgery following recurrence of symptoms after excision of an interdigital neuroma are poor. In a large series, Stamatis and Myerson reported less than a 50% good outcome following revision surgery.Correct Answer: 50%

1168. (2794) Q3-3292:

A patient presents for treatment of a dislocated second metatarsophalangeal joint. Radiographs demonstrate the dislocation. In addition to soft tissue balancing, you perform an oblique shortening osteotomy of the second metatarsal head (Weil). The most common complication following this osteotomy is:

1) Recurrent dislocation
3) Arthritis of the second metatarsophalangeal joint
2) Avascular necrosis of the metatarsal head
5) Claw toe deformity
4) Elevation of the second toe

The Weil osteotomy is a good procedure to correct deformity about the lesser metatarsophalangeal joint but is associated with potential complications, the most common of which is elevation of the second toe. As a result of shortening and plantar shifting of the metatarsal, the intrinsic muscles shift dorsally and can function as a dorsiflexor of the metatarsophalangeal joint.Correct Answer: Elevation of the second toe

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1169. (2795) Q3-3293:

A 26-year-old professional football player presents for evaluation of ankle pain. He was playing in a match 2 days ago and felt a pop in his ankle. On examination, the peroneal tendon is felt to subluxate anterior to the fibula. Magnetic resonance imaging confirms a tear of the superior peroneal retinaculum. Recommended treatment includes:

1) Immobilization in a short leg walking cast
3) Repair of the superior peroneal retinaculum
2) Immobilization in a hinged range of motion walker boot
5) Periosteal-tendon flap repair of the subluxated tendon
4) Deepening of the fibular groove

An acute dislocation of the peroneal tendon must be repaired. The results of immobilization are not predictable and, in a professional athlete, the added potential for failure with nonoperative treatment must be considered. With a rupture of the superior peroneal retinaculum likely to be the cause of the dislocation, the peroneal tendon should be repaired. When repair of an acute dislocation is performed, it should not be necessary to deepen the fibular groove.Correct Answer: Repair of the superior peroneal retinaculum

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1170. (2796) Q3-3294:

A patient presents for treatment of a painful hallux. The pain is over the dorsal surface of the hallux metatarsophalangeal joint and is worsened with plantar flexion of the toe. The passive range of motion is 30Â° of dorsiflexion and 10Â° of plantarflexion. The radiographs confirm the presence of mild arthritis of the metatarsophalangeal joint, with dorsal osteophytes on the metatarsal head. Which of the following procedures is most likely to be associated with a long-term satisfactory outcome:

1) Arthrodesis of the hallux metatarsophalangeal joint
3) Implant hemiarthroplasty
2) Soft tissue interposition arthroplasty
5) Cheilectomy of the metatarsophalangeal joint
4) Total joint arthroplasty

The pain present in plantarflexion is common and associated with friction of the capsule against the dorsal osteophytes. This patient has noted only mild arthritis of the metatarsophalangeal joint. An arthrodesis is not a necessary treatment, although it is a reasonable alternative. Implant and interposition arthroplasty are alternatives for the treatment of arthritis of the metatarsophalangeal joint but preferably only when the condition is advanced.Correct Answer: Cheilectomy of the metatarsophalangeal joint

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1171. (2797) Q3-3295:

Slide 1

This patient is a 17-year-old athlete who presents for treatment of a feeling of giving way of the ankle. The inversion clinical stress is demonstrated below (Slide). Which statement concerning the image presented below is correct:

1) Ankle instability is present.
3) Ankle and subtalar instability are present.
2) Subtalar instability is present.
5) No determination of instability can be made from this picture.
4) Generalized ligamentous laxity is present.

Although some laxity may be present in this patient, it is impossible to determine whether this is present in the ankle or the subtalar joint based upon this clinical test. Simple inversion stress without simultaneously palpating the lateral shoulder of the talus cannot indicate the presence or the type of instability. An anterior drawer that is positive and, in particular, is associated with a vacuum phenomenon in the anterolateral ankle is more diagnostic of ankle instability.Correct Answer: No determination of instability can be made from this picture.

1172. (2798) Q3-3296:

Slide 1

What structure is held in between the forceps in this photograph (Slide):

1) Anterior talofibular ligament
3) Calcaneofibular ligament
2) Peroneus tertius tendon
5) Interosseous ligament
4) Extensor retinaculum

The extensor retinaculum is an important structure in maintaining and possibly augmenting the stability of the lateral ankle and subtalar joint. The inferior root of the extensor retinaculum inserts in the floor of the sinus tarsi, improving stability of the subtalar joint. This structure can be used to augment a repair of ankle instability.Correct Answer: Extensor retinaculum

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1173. (2799) Q3-3297:

Slide 1

A 37-year-old woman injured her ankle 17 weeks ago when stepping off a sidewalk. She has experienced pain in the ankle since that time, and no treatment has yet been initiated. Presented is a view of the ankle performed with external rotation stress (Slide). The recommended treatment at this time is:

1) Repair of the deltoid ligament
3) Screw fixation of the syndesmosis
2) Repair of the deltoid ligament and open reduction of the syndesmosis
5) Open reduction internal fixation of a high fibular fracture and repair of the deltoid ligament
4) Open reduction internal fixation of a high fibular fracture

This unstable ankle is associated with a complete disruption of the syndesmosis. With the information available, it is not likely that a high fibular fracture is present. One has to assume that the injury is limited to the syndesmosis. Although the deltoid ligament may be torn, one cannot determine this until the time of surgery. At surgery, if the mortise reduces well following insertion of screw(s), then the deltoid is left alone. If the talus does not reduce, then there may be deltoid tissue that needs to be removed before the reduction can be accomplished.Correct Answer: Screw fixation of the syndesmosis

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1174. (2800) Q3-3298:

Slide 1 **Slide 2**

A 42-year-old male patient presents with a history of repeated giving way of his ankle. He notes that this has been present for 1 year. He does not experience any pain, even with the episodic bouts of the ankle buckling. On examination, the ankle range of motion is normal, no pain is elicited, and there is no crepitus. A stress radiograph (Slide 1) and a lateral weight-bearing radiograph (Slide 2) are presented. The patient does not want to undergo surgery, but he needs to know the possibility of problems with his ankle in the future. The patient should be advised that:

1) A high incidence of subsequent ankle arthritis is likely.
3) He is likely to develop an osteochondral injury of the talus.
2) The episodes of ankle instability will decrease over time.
5) He is not likely to experience any problem other than intermittent giving way of the ankle in the future.
4) His ankle may dislocate with a future inversion injury.

Ankle arthritis is rarely idiopathic. In the United States, the most common source of ankle arthritis is following trauma, usually of a major nature. Repetitive ankle injury, particularly when associated with recurrent instability and a varus or cavus foot, will likely lead to the development of ankle arthritis. Patients should be counseled that recurrent instability of the ankle, particularly when osteophytes are already present, frequently leads to arthritis.Correct Answer: A high incidence of subsequent ankle arthritis is likely.

1175. (2801) Q3-3299:

Slide 1

A 73-year-old woman states that she has been tripping over her right foot for the past year (Slide). She walks with a limp, and she states that her foot âslapsâ the ground. On examination, weakness in which muscle is likely present:

1) Gastrocnemius
3) Posterior tibial
2) Anterior tibial
5) Peroneus longus and brevis
4) Flexor hallucis longus

This patient presents with a typical rupture of the anterior tibial tendon. She reports a drop foot, commonly perceived by the patient as a slapping sensation of the foot when attempting to lift the foot up as the heel contacts the ground. Note the slight extension of the hallux, indicating chronic overuse in an attempt to provide accessory dorsiflexion of the ankle.Correct Answer: Anterior tibial

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1176. (2802) Q3-3300:

Slide 1

A 76-year-old man has experienced aching in the anterior aspect of his ankle for 6 months. He felt a sudden onset of soreness 6 months ago. Since then, he has noted weakness of the foot. He walks with a limp, and the foot hits the ground during the heel contact phase of gait. On examination there is a mobile subcutaneous mass in the anterior ankle. The patientâs magnetic resonance image (MRI) is presented (Slide). Which of the following is the most accurate diagnosis:

1) A ganglion of the anterior ankle
3) Pigmented villonodular synovitis
2) Synovial sarcoma
5) An accessory extensor hallucis longus
4) A rupture of the anterior tibial tendon

This MRI presents the typical appearance of an anterior tibial tendon rupture. There is no continuity of the tendon distally, and the retracted tendon end has formed a scar palpable as a subcutaneous mass. The clinical history of the weakness associated with a drop foot gait is characteristic of the tendon rupture.Correct Answer: A rupture of the anterior tibial tendon

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1177. (2803) Q3-3301:

Slide 1

A 23-year-old carpenter fell off a roof 4 weeks ago. He has pain in the ankle and a deformity. The lateral radiograph is presented (Slide). Which of the following treatments is most likely to return this patient to work with a functioning foot and ankle:

1) Open reduction internal fixation of the calcaneus fracture
3) Immediate vigorous physical therapy emphasizing range of motion
2) Short leg cast, no weight bearing for 8 weeks, followed by physical therapy
5) Physical therapy, followed by subtalar arthrodesis at 6 months
4) Open reduction internal fixation of the calcaneus fracture with primary subtalar arthrodesis

The calcaneus fracture is associated with subluxation of the subtalar joint, giving the appearance of injury to the talus and calcaneus. The true extent of the injury cannot be determined without a computed tomography scan; however, the question is not as to the outcome of treatment, but the ability to return this patient to his occupation. At 4 weeks following injury, while open reduction internal fixation of the fracture is possible, anatomic reduction may be difficult. The most likely means of returning this patient to work is with early arthrodesis, which should be combined with an open reduction internal fixation of the calcaneus.Correct Answer: Open reduction internal fixation of the calcaneus fracture with primary subtalar arthrodesis

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1178. (2804) Q3-3302:

Slide 1 **Slide 2**

A patient underwent an arthrodesis of the hallux metatarsophalangeal joint for correction of painful arthritis (Slide 1 and Slide 2). She remains symptomatic and cannot walk without pain. The most likely cause for her pain is:

1) Fusion of the hallux in too much plantarflexion
3) Fusion of the hallux in too much varus
2) Fusion of the hallux in too much dorsiflexion
5) Removal of too much bone in the metatarsophalangeal joint during fusion, leading to lesser toe metatarsalgia
4) Removal of too much bone in the metatarsophalangeal joint during fusion, leading to claw hallux

The ideal position for arthrodesis of the hallux metatarsophalangeal joint is in 5Â° of valgus, 10Â° of dorsiflexion relative to the ground, and neutral rotation. Although the hallux is short and may be associated with painful metatarsalgia, the most likely cause of pain is abutment of the hallux against the shoe because it was fused in varus.Correct Answer: Fusion of the hallux in too much varus

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1179. (2805) Q3-3303:

Slide 1

A 53-year-old woman presents for treatment of painful toe and metatarsal deformities (Slide). She underwent surgery to the hallux 2 years ago for correction of arthritis of the hallux metatarsophalangeal joint. Pain in the joint persists. She has no systemic disease, and the opposite foot is normal. What is the ideal surgical correction for her forefoot:

1) Capsulotomy of the lesser toe metatarsophalangeal joints and extensor tendon lengthening with temporary K-wire fixation
3) Arthrodesis of the hallux metatarsophalangeal joint with interposition bone block graft
2) Resection of the lesser metatarsal heads
5) Revision resection arthroplasty of the hallux and resection of the lesser metatarsal heads
4) Shortening osteotomies of the lesser toe metatarsals and arthrodesis of the hallux metatarsophalangeal joint

Resection of the lesser metatarsal heads is an operation that is commonly performed for patients with rheumatoid arthritis; however, this may also be performed for patients with debilitating metatarsalgia in the absence of systemic disease. Capsulotomy and tendon lengthening will not correct the alignment of the lesser toes or address the metatarsalgia. Revision of the resection arthroplasty will not address the metatarsalgia, and recurrent deformity of the hallux is likely. Shortening osteotomies of the metatarsal will decompress the joint, realign the toes, and decrease the metatarsalgia, particularly if performed in conjunction with metatarsophalangeal arthrodesis. A lengthening bone block fusion is not necessary.Correct Answer: Shortening osteotomies of the lesser toe metatarsals and arthrodesis of the hallux metatarsophalangeal joint

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1180. (2806) Q3-3304:

A 17-year-old patient presents with pain in the second toe. Pain becomes worse with exercise and has been present for 6 months. On examination, swelling is present around the metatarsophalangeal joint, and pain is present over the joint and upon squeezing the forefoot. Radiographic evaluation demonstrates a lucency in the second metatarsal head. The most likely cause of this condition is:

1) Second web space neuroma
3) Stress fracture of the second metatarsal
2) Idiopathic synovitis of the second metatarsophalangeal joint
5) Osteochondrosis of the second metatarsal head
4) Pigmented villonodular synovitis of the second metatarsophalangeal joint

This patient has the typical features of Freibergâs osteochondrosis of the second metatarsal head. There is swelling present, which is not noted in association with a neuroma, even though the clinical findings may be similar. Synovitis is common but not associated with radiographic changes.Correct Answer: Osteochondrosis of the second metatarsal head

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1181. (2900) Q3-3401:

Slide 1 **Slide 2** **Slide 3**

An 11-year-old girl presents with chronic foot pain. Her mother notes that her daughter has had flatfeet since birth, but the condition is worsening. The patient has aching in her foot, the arch of her foot, and her leg with walking and activities. She has been treated for 3 years with various orthotic arch supports. The foot is mobile and flexible on examination. Radiographs (Slide 1 and Slide 2) and a photograph (Slide 3) of her foot are presented. Which of the following surgical treatment alternatives is unacceptable in this patient:

1) Excision of an accessory navicular
3) Excision of a middle facet tarsal coalition
2) Subtalar arthroerisis
5) Lateral column lengthening osteotomy of the calcaneus
4) Medial calcaneus osteotomy

This patient has a flexible flatfoot deformity associated with a painful accessory navicular. No clinical or radiographic findings of a tarsal coalition are present. In addition to excision of the accessory navicular and advancement of the posterior tibial tendon, either a subtalar arthroerisis or an osteotomy of the calcaneus may be necessary.Correct Answer: Excision of a middle facet tarsal coalition

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1182. (2901) Q3-3402:

Slide 1 **Slide 2**

A 12-year-old girl was successfully treated for a flexible flatfoot deformity on the left foot. A clinical photograph (Slide 1) of her foot and a lateral radiograph (Slide 2) are presented. What is the purpose of the implant noted under the talus in the radiograph:

1) To plantarflex the first metatarsal
3) To restrict eversion of the subtalar joint
2) To tighten the Achilles tendon
5) To improve the alignment of the foot
4) To control sinus tarsi irritation by joint distraction

The subtalar arthroerisis, as demonstrated in the radiograph, is used to control eversion of the subtalar joint during the foot flat phase of gait. A subtalar arthroerisis limits excessive eversion but does not restrict subtalar motion further. This procedure is indicated for a patient who has a flexible flatfoot deformity and can be used either as the sole or an adjunctive procedure for correction.Correct Answer: To restrict eversion of the subtalar joint

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1183. (2902) Q3-3403:

Slide 1 **Slide 2**

The patient presented (Slide 1 and Slide 2) has a hereditary sensory motor neuropathy. Based upon the photographs, a surgeon should be able to determine the pattern of muscle weakness. Weakness in which muscle is most likely the cause of this deformity:

1) Anterior tibial
3) Gastrocnemius
2) Posterior tibial
5) Peroneus brevis
4) Peroneus longus

Although the anterior tibial muscle is weak, the cavus is the predominant deformity of this condition, caused by weakness of the peroneus brevis. The peroneus longus is functioning and is responsible for the plantarflexion of the first metatarsal.Correct Answer: Peroneus brevis

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1184. (2903) Q3-3404:

Slide 1 **Slide 2**

You are planning a tendon transfer to help correct deformity in a patient with hereditary sensory motor neuropathy. Which of the following muscles will be used for the transfer based upon the clinical appearance of the foot (Slide 1 and Slide 2):

1) Posterior tibial
3) Extensor hallucis longus
2) Anterior tibial
5) Flexor hallucis longus
4) Peroneus brevis

The posterior tibial tendon transfer is a commonly performed surgery for correction of cavus foot deformity associated with weakness of the anterior tibial muscle and varying degrees of drop foot deformity. The removal of the force of the posterior tibial tendon adds to the correction of the deformity of the foot by balancing the absent peroneus brevis. Although the extensor hallucis longus can be used as a tendon transfer, it will not be the primary muscle used or sufficient to correct deformity.Correct Answer: Posterior tibial

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1185. (2904) Q3-3405:

Which combination of muscle weakness is typically associated with hereditary sensory motor neuropathy:

1) Anterior tibial, extensor hallucis longus
3) Gastrocnemius, peroneus brevis
2) Peroneus longus, extensor hallucis brevis
5) Anterior tibial, peroneus brevis
4) Posterior tibial, extensor digitorum brevis

The peroneus brevis is usually the first muscle to atrophy. Varying patterns of loss of the other muscles of the lower extremity include the anterior tibial and, in particular, the intrinsic foot muscles. Weakness in these muscles accounts for the cavus and the claw foot deformities noted in patients with hereditary sensory motor neuropathy.Correct Answer: Anterior tibial, peroneus brevis

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1186. (2905) Q3-3406:

Slide 1

A 42-year-old man with diabetes presents for treatment of a swollen foot (Slide). He does not recall the onset of swelling, and he states that his foot is not painful. On examination, the foot is hot to touch and swollen. Upon radiographic examination, no deformities are evident. Which of the following treatment options should be used next:

1) Short leg cast
3) Biopsy of the midfoot
2) Magnetic resonance image scan
5) Initiation of organism-specific intravenous antibiotic therapy
4) Technetium and indium scan

This patient presents with an acute neuroarthropathy. The acute painless swelling, associated with warmth and absence of radiographic findings, is typical of the acute phase of a Charcot process. A short leg cast or a boot to immobilize the foot is ideal, and no weight bearing should be permitted until the acute phase of this neuroarthropathy has subsided.Correct Answer: Short leg cast

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1187. (2906) Q3-3407:

Slide 1

A 29-year-old woman presents for treatment of a swollen foot. Although her foot is not painful, it has been swollen for 2 weeks. The patient walks into the office without any assistive device. On examination, the foot is swollen and warm. The patient does not have protective sensation in the foot, and she denies a history of diabetes and does not have a clinically relevant medical history. A radiograph of her foot is presented (Slide). Which of the following tests will be most helpful in determining the etiology of her condition:

1) Hemoglobin A1
3) White cell count
2) C-reactive protein
5) Spinal fluid analysis from lumbar puncture
4) Sedimentation rate

This patient most likely has diabetes. Patients may present for the first time with an acute neuroarthropathy of the foot as a result of diabetes, even without a clinical history of the disease. Although the sedimentation rate will likely be elevated, it will not help in the diagnosis. Infection is not a likely consideration in this patient.Correct Answer: Hemoglobin A1

1188. (2907) Q3-3408:

Slide 1 **Slide 2** **Slide 3**

A patient with diabetes and severe peripheral neuropathy has been treated for a Charcot ankle deformity for 9 months (Slide 1, Slide 2, and Slide 3). An ankle foot orthosis has been used for 4 months. No skin breakdown occurred in the brace. Swelling is present but has decreased over the past month. Ankle range of motion is limited, and crepitus is present upon examination of the ankle. Which surgical procedure is most consistent with the future treatment of this patient:

1) Surgery with tibiotalocalcaneal arthrodesis
3) Surgery with pantalar arthrodesis
2) Surgery with ankle arthrodesis
5) Continued use of an orthosis
4) Talectomy and tibiocalcaneal arthrodesis

The indication for surgery is intractable deformity, which is refractory to all forms of bracing. By refractory, one implies that skin breakdown or imminent infection is present. If surgery were performed, then it would consist of a tibiotalocalcaneal arthrodesis. There are no indications for this surgery in this patient. Once the neuropathic process has reached a stable point, a deformity is not likely to progress.Correct Answer: Continued use of an orthosis

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1189. (2908) Q3-3409:

Slide 1

An 83-year-old woman presents for treatment of a painful second toe deformity. The hallux, the bunion, and the third toe are not painful. A fixed crossover toe deformity is present (Slide), with a dislocation of the second metatarsophalangeal joint noted radiographically. Which procedure is likely to give the patient rapid pain relief:

1) Arthrodesis of the hallux metatarsophalangeal joint and resection arthroplasty of the second proximal interphalangeal joint
3) Shortening osteotomies of the second and third metatarsals and interphalangeal arthroplasty
2) Osteotomy of the second toe and metatarsal
5) Resection arthroplasty of the hallux metatarsophalangeal joint
4) Amputation of the second toe at the metatarsophalangeal joint

In this age group, amputation of the second toe is a reasonable treatment. It is not possible to correct the second toe deformity without correction of the hallux, either by arthrodesis or arthroplasty at the metatarsophalangeal joint. The hallux is asymptomatic, which is common in this age group, and the simplest treatment is to amputate the toe.Correct Answer: Amputation of the second toe at the metatarsophalangeal joint

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1190. (2909) Q3-3410:

Slide 1

A 60-year-old man experiences pain under the lesser metatarsal heads. Prominence of the metatarsal heads under the second, third, and fourth metatarsal is noted, as well as associated fixed claw toe deformities (Slide). The etiology of the foot pain is:

1) Contracture of the long flexor tendons
3) Atrophy of the intrinsic muscles of the foot
2) Fat pad atrophy
5) Idiopathic (the cause is either unknown or not understood)
4) Contracture of the long extensor tendon

The cause of claw toe deformity is not idiopathic. Claw toe deformity is a common deformity in adults, particularly in women as a result of lack of use of the intrinsic muscles of the foot, leading to an imbalance between the extrinsic and intrinsic muscles in the foot. As the intrinsic muscle atrophies, the long extensor and flexor tendons cause the deformity (as presented in this patient), with resulting metatarsalgia.Correct Answer: Atrophy of the intrinsic muscles of the foot

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1191. (2910) Q3-3411:

Slide 1

A patient presents with a claw toe deformity (Slide). What is the strongest flexor of the metatarsophalangeal joint, which in this patient is not functioning adequately:

1) Flexor digitorum longus
3) Lumbrical
2) Flexor digitorum brevis
5) Interosseous
4) Volar plate

Although the long and short flexor tendons have some effect albeit indirect on the flexion of the metatarsophalangeal joint, the flexor that acts directly on the joint is the interosseous muscle. Intrinsic atrophy will lead to claw toe deformity.Correct Answer: Interosseous

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1192. (2911) Q3-3412:

Slide 1

A 54-year-old woman presents for treatment of an ulcer (Slide). She has diabetes, no protective sensation, and slight deformity of the foot. There is no inflammation of the foot and no purulent drainage. Slight serous oozing is present daily. Initial evaluation and treatment should consist of:

1) Ambulation in a total contact cast
3) Bed rest, no weight bearing, and daily dressing changes
2) Biopsy, culture, and organism-specific oral antibiotic therapy
5) Correction of the Charcot foot deformity and antibiotic therapy
4) Ambulation in a stiff-soled surgical shoe with a protective dressing

Ambulatory treatment for a patient with diabetes is always the preferable treatment. In this patient, there is no evidence of infection. Unless drainage is purulent and the ulcer is in contact with bone, there should be minimal concern for infection. Reconstruction of a Charcot deformity of the midfoot is only indicated following repeated failure of nonoperative treatments.Correct Answer: Ambulation in a total contact cast

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1193. (2912) Q3-3413:

Slide 1

A 63-year-old patient underwent a triple arthrodesis for correction of flatfoot deformity. He presents with continued ankle pain, as well as a hindfoot valgus deformity. The ankle deformity is flexible, and the joint can be reduced. All of the following are reasonable surgical alternatives as a single or staged procedure with the exception of:

1) Ankle arthrodesis
3) Total ankle replacement
2) Revision of the triple arthrodesis and translational osteotomy of the calcaneus
5) Peroneal tendon transfer
4) Deltoid ligament repair

Repair of a chronically torn deltoid ligament is not sufficient to correct this type of deformity. The ligament has degenerated, and the quality of the ligament is insufficient. Each of the other alternatives is reasonable either performed as the sole or adjunctive procedure.Correct Answer: Deltoid ligament repair

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1194. (2913) Q3-3414:

A 34-year-old patient presents for treatment of painful ankle arthritis. Deformity of the ankle is present with posttraumatic arthritis and 20Â° of varus deformity as a result of erosion of the distal tibial plafond. There is minimal motion of the subtalar joint, and the forefoot is plantigrade. You plan an ankle arthrodesis. In addition to the position of the ankle arthrodesis, what additional procedure should you consider:

1) Subtalar arthrodesis
3) Medial translational calcaneus osteotomy
2) Ankle ligament reconstruction
5) Triple arthrodesis
4) First metatarsal dorsal wedge osteotomy

This patient has a fixed deformity of the ankle, as well as the hindfoot. The subtalar joint has adapted to the varus position of the ankle but is stiff. Following the ankle arthrodesis, which has to be performed by bringing the ankle into a few degrees of varus, the forefoot will not be able to compensate for the fixed changes that have taken place in the hindfoot. To keep the forefoot plantigrade, a dorsal wedge osteotomy of the first metatarsal should be performed to keep the foot plantigrade.Correct Answer: First metatarsal dorsal wedge osteotomy

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1195. (2914) Q3-3415:

A 26-year-old woman presents for treatment of ankle arthritis following trauma. She is an active individual despite her arthritis. On examination, her foot is fixed in equinus, no ankle motion is present, and the motion in the subtalar joint is normal. Ankle arthritis is noted radiographically. In a preoperative discussion, she states the desire to have as mobile a foot as possible, wear high heel shoes, and participate in realistic exercise activities. You perform an ankle arthrodesis. What is the ideal position for the arthrodesis:

1) 10Â° of dorsiflexion, 5Â° of valgus, and neutral rotation
3) 10Â° of plantarflexion, 10Â° of valgus, and neutral rotation
2) Neutral dorsiflexion, 15Â° of valgus, and neutral rotation
5) Neutral dorsiflexion, 5Â° of valgus, and neutral rotation
4) 10Â° of plantarflexion, neutral valgus, and 10Â° of external rotation

Regardless of patient activities, desire for shoe wear, and age, the ankle must be fused in a standard position of neutral dorsiflexion and slight valgus. This is important because any deviation of this position, particularly in equinus, will increase the likelihood of arthritis in the talonavicular and subtalar joint.Correct Answer: Neutral dorsiflexion, 5Â° of valgus, and neutral rotation

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1196. (2915) Q3-3416:

Slide 1 **Slide 2**

A 22-year-old man has experienced pain in his foot and ankle for 10 years. His radiographs are presented (Slide 1 and Slide 2). The foot is flexible, and pain is present in the sinus tarsi and along the medial border of the foot. With the subtalar joint held in a reduced neutral position, the forefoot is in 15Â° of supination. You attempt orthotic arch supports and when these do not alleviate his pain, a brace is suggested. He refuses to wear a brace. You plan an osteotomy of the calcaneus with lengthening bone graft at the neck of the calcaneus (lateral column lengthening). The most common complication following this procedure is:

1) Calcaneocuboid joint arthritis
3) Persistent sinus tarsi pain
2) Subtalar arthritis
5) Elevation of the first metatarsal
4) Equinus deformity

This patient demonstrates the common finding of fixed forefoot varus associated with a flexible flatfoot deformity. It is likely that a gastrocnemius contracture is also present, but this is not always the case. Arthritis of the calcaneocuboid joint rarely occurs following a lengthening calcaneal osteotomy in an adult. Correction of the forefoot varus is best accomplished with an opening wedge osteotomy of the medial cuneiform. Arthrodesis of the first tarsometatarsal joint may be performed in selected patients with noted instability at this joint.Correct Answer: Elevation of the first metatarsal

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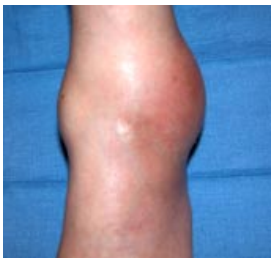
1197. (2916) Q3-3417:



Slide 1 **Slide 2** **Slide 3**

A 44-year-old obese man presents for treatment of acute ankle pain. He does not have a history of trauma or a systemic history of note. His opposite foot has had multiple episodes of acute pain in the past, lasting from 3 to 5 days. On examination, the ankle is warm, swollen, and exquisitely tender to palpation and any range of motion (Slide1, Slide 2, and Slide 3). Concerned about the source of pain, you aspirate the joint and send the sample for analysis. You expect to find:

1) Gram-positive cocci
3) Normal joint fluid
2) Gram-negative rods
5) A high red cell count
4) Sodium monourate crystals

This patient most likely has an acute attack of gout. The prior episodes of foot pain and the sudden onset lasting 5 days for each bout is characteristic. The ankle is not a common location for gout (the most frequent site is the hallux metatarsophalangeal joint). The treatment should consist of injection of a corticosteroid into the joint and administration of appropriate oral anti-inflammatory medication.Correct Answer: Sodium monourate crystals

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1198. (2917) Q3-3418:

Slide 1

This patient presents for treatment of a painful hallux varus deformity following correction of hallux valgus deformity (Slide). All of the following procedures may be acceptable surgical alternatives for correction of deformity with the exception of:

1) Split extensor hallucis longus tendon transfer
3) Extensor hallucis brevis tendon transfer
2) Abductor hallucis transfer
5) Hallux metatarsophalangeal joint arthrodesis
4) First metatarsal osteotomy

The extensor hallucis longus or the extensor hallucis brevis (rarely the abductor hallucis) may be used as a tendon transfer for correction. Arthrodesis of the hallux interphalangeal joint may be performed for correction of a fixed claw deformity of the interphalangeal joint, usually in conjunction with a tendon transfer. Arthrodesis of the metatarsophalangeal joint is a reasonable alternative provided there is no fixed deformity of the interphalangeal joint present and when arthritis or fixed deformity of the metatarsophalangeal joint is present.Correct Answer: First metatarsal osteotomy

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1199. (3084) Q3-3592:

Which of the following is true concerning Achilles tendon ruptures:

1) More common in women than men
3) More common in patients using cephalosporins
2) More common on the right side compared to the left
5) Occurs most commonly in normal tendons
4) A common mechanism of injury is sudden forced foot plantarflexion

Important points to remember about Achilles tendon ruptures:

A. Most common in middle-aged men
B. Often intermittent sports activity
C. Left more than right
D. Often the tendon is abnormal (degenerative)
E. Mechanism
    1. Sudden forced plantarflexion
    2. Unexpected dorsiflexion
    3. Violent dorsiflexion of the plantar flexed foot

Factors which may make the patient more prone to rupture:

A. Steroids
B. Fluoroquinolones

Correct Answer: A common mechanism of injury is sudden forced foot plantarflexion

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1200. (3085) Q3-3593:

Which of the following is true concerning the repair of acute Achilles tendon ruptures:

1) Open treatment has a higher rerupture and infection rate than nonoperative treatment.
3) Open treatment has a lower rerupture rate but higher infection rate compared to nonoperative treatment.
2) Open treatment has a higher rerupture rate but lower infection rate compared to nonoperative treatment.
5) Open treatment has the same rerupture rate compared to nonoperative treatment.
4) Open treatment has a lower rerupture rate and lower infection rate compared to nonoperative treatment.

This meta-analysis showed:
Operative versus nonoperative (pooled rates):

Rerupture

Operative	3.5% (6/173) (relative risk 0.27)
Nonoperative	12.6% (23/183)

Complications (adhesions, infection, disturbed sensibility)

Operative	34.1% (59/173) (relative risk 10.60)
Nonoperative	2.7% (5/183)

Infection

Operative	4.0% (7/173) (relative risk 4.89)
Nonoperative	0%

Correct Answer: Open treatment has a lower rerupture rate but higher infection rate compared to nonoperative treatment.

1201. (3086) Q3-3594:

When counseling a patient concerning the treatment of an acute Achilles tendon rupture, which of the following is true:

1) The relative risk of rerupture is 10 times greater in patients treated nonoperatively.
3) The relative risk of complications in the operative group is twice as high as those treated nonoperatively.
2) The relative risk of infection is five times greater in patients treated operatively.
5) The relative risk of rerupture is two times higher with nonoperative treatment.
4) The relative risk of rerupture is equal between the operative and nonoperative treatment.

This meta-analysis showed:
Operative versus nonoperative (pooled rates):

Rerupture

Operative	3.5% (6/173) (relative risk 0.27)
Nonoperative	12.6% (23/183)

Complications (adhesions, infection, disturbed sensibility)

Operative	34.1% (59/173) (relative risk 10.60)
Nonoperative	2.7% (5/183)

Infection

Operative	4.0% (7/173) (relative risk 4.89)
Nonoperative	0%

Correct Answer: The relative risk of infection is five times greater in patients treated operatively.

1202. (3087) Q3-3595:

Following open repair of an Achilles tendon rupture, which of the following is true:

1) Casting alone has a lower risk or rerupture compared to casting followed by functional bracing.
3) There is a higher complication rate in the group treated by casting followed by functional bracing compared to casting alone.
2) Casting alone has a higher rate of rerupture compared to casting followed by functional bracing.
5) Casting followed by functional bracing has an unacceptable rerupture rate.
4) Casting alone has a lower rerupture rate and complication rate compared to casting followed by functional bracing.

This meta-analysis showed:

Postoperative splinting: cast alone compared with cast followed by functional bracing

Rerupture

Cast alone	5.0% (7/140) (relative risk 2.04)
Cast followed by functional bracing	2.3% (3/133)

Complications (adhesions, infection, disturbed sensibility):

Cast alone	35.7% (50/140) (relative risk 1.88)
Cast followed by functional bracing	19.5% (26/133)

Correct Answer: Casting alone has a higher rate of rerupture compared to casting followed by functional bracing.

1203. (3095) Q3-3605:

Which of the following is the most useful symptom or sign of a foot compartment syndrome:

1) Numbness in the lateral plantar nerve distribution
3) Decreased capillary refill
2) Weakness of toe extension (interossei muscles)
5) Weakness of ankle plantarfexion
4) Severe pain

Pain out of proportion to injury is the most reliable indicator of a foot compartment syndrome. Foot compartment syndromes can be difficult to diagnose compared to compartment syndromes of the leg. In the leg, one can rely on motor and nerve testing while motor testing in the foot is difficult secondary to the pain from the injury. The severe pain is usually out of proportion to injury. Pain suggestive of compartment syndrome includes:

- Unremitting pain
- Pain not responsive to increasing doses of narcotics
- Pain that is so severe the patient cannot lie still or cooperate with the examiner

Correct Answer: Severe pain

1204. (3096) Q3-3606:

Which of the following is the most useful sign in diagnosing a foot compartment syndrome:

1) Numbness in the lateral plantar nerve distribution
3) Weakness with toe dorsiflexion
2) Numbness in the medial plantar nerve distribution
5) Severe pain with passive toe flexion
4) Weakness when testing ankle plantarflexion

Pain with passive stretch is a reliable sign in compartment syndrome of the leg, foot, and ankle. In Myersonâs study, he found that pain with passive stretch was present in 86% of patients when those intrinsic muscles of the foot were stretched.Correct Answer: Severe pain with passive toe flexion

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1205. (3097) Q3-3607:

Which of the following compartments are most commonly involved (increased tissue pressure) in compartment syndrome of the foot:

1) Superficial
3) Calcaneal
2) Medial
5) First interosseus
4) Adductor

The calcaneal compartment is most commonly involved in foot compartment syndromes. Approximately 5% to 10% of calcaneus fractures are complicated by a compartment syndrome. The cancellous bone of the calcaneus may have significant bleeding. Swelling of the hindfoot can be severe.Correct Answer: Calcaneal

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1206. (3098) Q3-3608:

Which of the following is the most commonly accepted number of foot compartments:

1) Three
3) Eight
2) Five
5) Twelve
4) Nine

The foot can be divided into nine distinct compartments.

A. Calcaneal compartment
    1. Quadratus plantae
    2. Posterior tibial nerve, artery, and vein
    3. Lateral plantar nerve, artery, and vein
    4. Medial plantar nerve (variable)

*Remember that the calcaneal compartment may communicate with the posterior tibial compartment.

A. Interosseiâ(four separate compartments)
B. Adductor muscle
C. Medial
    1. Flexor hallucis brevis
    2. Abductor hallucis
D. Lateral
    1. Abductor digiti minimi
    2. Flexor digiti minimi
E. Superficial
    1. Flexor digitorum brevis
    2. Lumbricals (four)
    3. Flexor digitorum longus
    4. Medial plantar nerve (variable)

Correct Answer: Nine

1207. (3099) Q3-3609:

Which of the following structures is in the calcaneal compartment of the foot:

1) Flexor hallucis
3) Flexor digitorum longus
2) Abductor digiti minimi
5) Flexor digiti minimi
4) Quadratus plantae

The foot can be divided into nine distinct compartments.

A. Calcaneal compartment
    1. Quadratus plantae
    2. Posterior tibial nerve, artery, and vein
    3. Lateral plantar nerve, artery, and vein
    4. Medial plantar nerve (variable)

    *Remember that the calcaneal compartment may communicate with the posterior tibial compartment.

B. Interosseiâ(four separate compartments)
C. Adductor muscle
D. Medial
    1. Flexor hallucis
    2. Abductor hallucis
E. Lateral
    1. Abductor digiti minimi
    2. Flexor digiti minimi
F. Superficial
    1. Flexor digitorum brevis
    2. Lumbricals (four)
    3. Flexor digitorum longus
    4. Medial plantar nerve (variable)

Correct Answer: Quadratus plantae

1208. (3100) Q3-3610:

Which of the following structures is in the medial compartment of the foot:

1) Abductor digiti minimi
3) Abductor hallucis
2) Flexor digiti minimi
5) Flexor digitorum longus
4) Flexor digitorum brevis

The foot can be divided into nine distinct compartments.

A. Calcaneal compartment
    1. Quadratus plantae
    2. Posterior tibial nerve, artery, and vein
    3. Lateral plantar nerve, artery, and vein
    4. Medial plantar nerve (variable)

    *Remember that the calcaneal compartment may communicate with the posterior tibial compartment.

B. Interosseiâ(four separate compartments)
C. Adductor muscle
D. Medial
    1. Flexor hallucis
    2. Abductor hallucis
E. Lateral
    1. Abductor digiti minimi
    2. Flexor digiti minimi
F. Superficial
    1. Flexor digitorum brevis
    2. Lumbricals (four)
    3. Flexor digitorum longus
    4. Medial plantar nerve (variable)

Correct Answer: Abductor hallucis

1209. (3101) Q3-3611:

Which of the following foot compartments communicates with the deep posterior tibial compartment:

1) Medial
3) Adductor
2) Lateral
5) Superficial
4) Calcaneal

The foot can be divided into nine distinct compartments.

A. Calcaneal compartment
    1. Quadratus plantae
    2. Posterior tibial nerve, artery, and vein
    3. Lateral plantar nerve, artery, and vein
    4. Medial plantar nerve (variable)

    *Remember that the calcaneal compartment may communicate with the posterior tibial compartment.

B. Interosseiâ(four separate compartments)
C. Adductor muscle
D. Medial
    1. Flexor hallucis
    2. Abductor hallucis
E. Lateral
    1. Abductor digiti minimi
    2. Flexor digiti minimi
F. Superficial
    1. Flexor digitorum brevis
    2. Lumbricals (four)
    3. Flexor digitorum longus
    4. Medial plantar nerve (variable)

Correct Answer: Calcaneal

1210. (3102) Q3-3612:

A 45-year-old man has severe, unremitting pain after sustaining a displaced calcaneus fracture. He is immobilized in a bulky compression dressing with plaster splints. After removing his dressing, he is noted to have marked swelling with no resolution of his pain. The next step in management is:

1) Ice and elevation
3) Application of a foot pump
2) Ice, elevation, and an increase in pain medication
5) Measurement of the calcaneal compartment tissue pressure
4) Epidural block for pain control

The patient has the most reliable finding in foot compartment syndromesâunremitting pain that is out of proportion to injury. When patients have unremitting pain following removal of a compression dressing, the compartment pressures should be measured to determine if a compartment syndrome is present.

If the tissue pressure is within 30 mm Hg of the diastolic pressure, the pressures are above 30 mm Hg, and a neurological deficit is present, a compartment syndrome has occurred and the patient should undergo an emergency fasciotomy.Correct Answer: Measurement of the calcaneal compartment tissue pressure

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1211. (3103) Q3-3613:

A 45-year-old man has severe, unremitting pain after sustaining a displaced calcaneus fracture. His hindfoot is swollen. The calcaneal compartment tissue pressure is 47 mm Hg. His diastolic pressure is 70 mm Hg. The next step in management is:

1) Ice and elevation
3) Application of a foot pump
2) Ice, elevation, and an increase in pain medication
5) Emergent release of the foot compartments
4) Epidural block for pain control

The patient has the most reliable finding in foot compartment syndromesâunremitting pain that is out of proportion to injury. When patients have unremitting pain following removal of a compression dressing, the compartment pressures should be measured to determine if a compartment syndrome is present.

If the tissue pressure is within 30 mm Hg of the diastolic pressure, the pressures are above 30 mm Hg, and a neurological deficit is present, a compartment syndrome has occurred and the patient should undergo an emergency fasciotomy.Correct Answer: Emergent release of the foot compartments

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1212. (3104) Q3-3614:

Which of the following groups of muscles are located in the first layer of the foot muscles:

1) Abductor hallucis, flexor digitorum brevis, quadratus plantae
3) Abductor, hallucis, flexor digitorum brevis, abductor digiti minimi
2) Flexor hallucis brevis, adductor hallucis, flexor digiti, minimi
5) Abductor hallucis, quadratus plantae, lumbricals
4) Quadratus plantae, lumbricals

The muscles of the foot and their innervations are as follows:

First Layer		
Abductor hallucis	MPN (S2,S3)	abducts and flexes
Flexor digitorum brevis	MPN (S2,S3)	flexes lateral four digits
Abductor digit minimi	LPN (S2,S3)	abducts and flexes fifth digit
Second Layer		
Quadratus plantae	LPN (S2,S3)	flexes lateral. four digits
Lumbricals	Medial one: MPN	flex MTPJ, ext PIP, DIP
Â	Lateral three: LPN	Â
Third Layer		
Flexor hallucis brevis	MPN (S2, S3)	flex MTPJ
Adductor hallucis	LPN (S2, S3)	abducts first digit
Flexor digiti minimi	LPN (S2, S3)	flex MTPJ
Fourth Layer		
Plantar interossei	LPN (S2,S3)	adducts digits flex MTPJ
Dorsal interossei	LPN (S2,S3)	adducts digits flex MTPJ

Abbreviations: MPN=medial plantar nerve, LPN=lateral plantar nerve, MTPJ=metatarsophalangeal joint, PIP=proximal interphalangeal joint, and DIP=distal interphalangeal joint.

Correct Answer: Abductor, hallucis, flexor digitorum brevis, abductor digiti minimi

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1213. (3105) Q3-3615:

Which of the following muscles are in the second layer of the foot:

1) Abductor hallucis, flexor digitorum brevis, abductor digiti minimi
3) Flexor hallucis brevis, abductor hallucis, flexor digiti minimi
2) Abductor hallucis, quadratus plantae
5) Plantar interossei, dorsal interossei
4) Quadratus plantae, lumbricals

The muscles of the foot and their innervations are as follows:

First Layer

Abductor hallucis	MPN (S2,S3)	abducts and flexes
Flexor digitorum brevis	MPN (S2,S3)	flexes lateral four digits
Abductor digit minimi	LPN (S2,S3)	abducts and flexes fifth digit

Second Layer

Quadratus plantae	LPN (S2,S3)	flexes lateral. four digits
Lumbricals	Medial one: MPN	flex MTPJ, ext PIP, DIP
Â	Lateral three: LPN	Â

Third Layer

Flexor hallucis brevis	MPN (S2, S3)	flex MTPJ
Adductor hallucis	LPN (S2, S3)	abducts first digit
Flexor digiti minimi	LPN (S2, S3)	flex MTPJ

Fourth Layer

Plantar interossei	LPN (S2,S3)	adducts digits flex MTPJ
Dorsal interossei	LPN (S2,S3)	adducts digits flex MTPJ

Abbreviations: MPN=medial plantar nerve, LPN=lateral plantar nerve, MTPJ=metatarsophalangeal joint, PIP=proximal interphalangeal joint, and DIP=distal interphalangeal joint.

Correct Answer: Quadratus plantae, lumbricals

1214. (3106) Q3-3616:

Which of the following groups of muscles are in the third layer of the foot:

1) Abductor hallucis, flexor digitorum brevis, abductor digiti minimi
3) Flexor hallucis brevis, adductor hallucis, flexor digiti minimi
2) Quadratus plantae, lumbricals
5) Dorsal interossei, plantar interossei
4) Flexor hallucis brevis, quadratus plantae, abductor digiti minimi

The muscles of the foot and their innervations are as follows:

First Layer

Abductor hallucis	MPN (S2,S3)	abducts and flexes
Flexor digitorum brevis	MPN (S2,S3)	flexes lateral four digits
Abductor digit minimi	LPN (S2,S3)	abducts and flexes fifth digit

Second Layer

Quadratus plantae	LPN (S2,S3)	flexes lateral. four digits
Lumbricals	Medial one: MPN	flex MTPJ, ext PIP, DIP
Â	Lateral three: LPN	Â

Third Layer

Flexor hallucis brevis	MPN (S2, S3)	flex MTPJ
Adductor hallucis	LPN (S2, S3)	abducts first digit
Flexor digiti minimi	LPN (S2, S3)	flex MTPJ

Fourth Layer

Plantar interossei	LPN (S2,S3)	adducts digits flex MTPJ
Dorsal interossei	LPN (S2,S3)	adducts digits flex MTPJ

Abbreviations: MPN=medial plantar nerve, LPN=lateral plantar nerve, MTPJ=metatarsophalangeal joint, PIP=proximal interphalangeal joint, and DIP=distal interphalangeal joint.

Correct Answer: Flexor hallucis brevis, adductor hallucis, flexor digiti minimi

1215. (3107) Q3-3617:

Which of the following muscles are innervated by the medial plantar nerve:

1) Abductor digiti minimi
3) Abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, medial lumbrical
2) Adductor hallucis, flexor digitorum brevis
5) Plantar interossei, dorsal interossei
4) Adductor hallucis, flexor digiti minimi, plantar interossei

The muscles of the foot and their innervations are as follows:

First Layer

Abductor hallucis	MPN (S2,S3)	abducts and flexes
Flexor digitorum brevis	MPN (S2,S3)	flexes lateral four digits
Abductor digit minimi	LPN (S2,S3)	abducts and flexes fifth digit

Second Layer

Quadratus plantae	LPN (S2,S3)	flexes lateral. four digits
Lumbricals	Medial one: MPN Lateral three: LPN	flex MTPJ, ext PIP, DIP

Third Layer

Flexor hallucis brevis	MPN (S2, S3)	flex MTPJ
Adductor hallucis	LPN (S2, S3)	abducts first digit
Flexor digiti minimi	LPN (S2, S3)	flex MTPJ

Fourth Layer

Plantar interossei	LPN (S2,S3)	adducts digits flex MTPJ
Dorsal interossei	LPN (S2,S3)	adducts digits flex MTPJ

Abbreviations: MPN=medial plantar nerve, LPN=lateral plantar nerve, MTPJ=metatarsophalangeal joint, PIP=proximal interphalangeal joint, and DIP=distal interphalangeal joint.

Correct Answer: Abductor hallucis, flexor digitorum brevis, flexor hallucis brevis, medial lumbrical

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1216. (3108) Q3-3618:

Which of the following is true of interdigital neuromas:

1) Interdigital neuromas are a benign neoplasm of the Schwann cell
3) Numbness is a common finding in interdigital neuromas
2) Interdigital neuromas most commonly occur in the second web space
5) There is an equal incidence of interdigital neuromas in men and women
4) Interdigital neuromas most commonly occur in the third web space

Discussion

Important core knowledge of interdigital neuroma (Morton's syndrome) includes:

A. Etiology-neither a neuroma nor a tumor; most likely degenerative from repetitive trauma from the transverse intermetatarsal ligament.
    1. Pathology-most commonly perineural fibrosis
B. Most common in the third web space (about 80%)
    1. Medial branch of the lateral plantar nerve joins the lateral branch of medial plantar curve
C. More common in women than men
D. Presentation
    1. Paresthesias, dysesthesias, burning sensation
    2. Diffuse symptoms in forefoot
    3. Pain is relieved by massaging the foot
    4. Numbness occurs as a late finding
E. Physical examination
    1. Tenderness to direct pressure in the web space
    2. Tenderness with forefoot compression

Correct Answer: Interdigital neuromas most commonly occur in the third web space

1217. (3109) Q3-3619:

Which of the following structures can cause chronic impingement-type posterior ankle pain athletes:

1) Flexor digitorum longus
3) Gastrocnemius soleus complex
2) Posterior tibialis
5) Peroneus quartus
4) Peroneus longus

Discussion

Posterior impingent can be caused by anomalous muscles. The most common is the peroneus quartus. Here are some important points.

Posterior ankle impingement-compression of the talus and surrounding soft tissues between the tibia and calcaneus

A. Cause-forced or repetitive plantar flexion of the foot
B. Occurs in dancers and athletes
C. Presentation-pain in the medial or lateral aspect of the ankle posteriorly with activities, especially plantar flexion
D. Physical examination-tenderness medial or lateral to the Achilles tendon
E. Diagnosis is difficult to make and often missed because of the following:
    1. Symptoms are reproduced by plantar flexion of the ankle
    2. Injections can be performed to see if the injection relieves the symptoms

Anomalous muscles about the ankle

A. Most common is the peroneus quartus (prevalence of the muscle between 7% and 22%)
    1. Arises from peroneus brevis and inserts into retrotrochlear eminence of the calcaneus
B. Peroneocalcaneus internus (1%)
    1. Arises from the fibula and inserts into under surface of sustentaculum tali
C. Long accessory to the long flexors or quadratus plantae (1%-8%)
D. Tibiocalcaneus internus
E. Accessory soleus

Correct Answer: Peroneus quartus

1218. (3110) Q3-3620:

Which of the following may cause impingement-type posterior ankle pain in dancers?

1) Gastrocnemius-soleus complex
3) Peroneus longus
2) Posterior tibialis
5) Flexor hallucis longus
4) Peroneus brevis

Discussion

Posterior ankle impingement caused by compression of the talus and surrounding soft tissues between the tibia and calcaneus. In dancers, symptoms may be caused by a low lying or enlarged flexor hallucis longus muscle.

A. Cause â forced or repetitive plantar flexion of the foot
B. Occurs in dancers and athletes
C. Presentation â pain in the medial or lateral aspect of the ankle posteriorly with activities, especially plantar flexion
D. Physical examination â tenderness medial or lateral to the Achilles tendon
E. Diagnosis is difficult to make and often missed
    1. Symptoms are reproduced by plantar flexion of the ankle
    2. Injections can be performed to see if the injection relieves the symptoms

Causes of posterior impingement:

A. Os trigonum
B. Enlarged lateral process of the talus

- Enlarged posterior process of the calcaneus
- Posterior intermalleolar ligament
- Soft tissue impingement
- Loose bodies
- Ganglia
- Low lying flexor hallucis longus muscle body
- Anomalous muscle bodies

Correct Answer: Flexor hallucis longus

1219. (3112) Q3-3622:

Which of the following statements about the gait cycle is true:

1) The swing phase is longer than the stance phase and lasts for 62% of the cycle.
3) At heel strike, the anterior tibialis muscle is quiescent.
2) From heel rise to toe-off, the tibia goes into external rotation.
5) From heel strike to toe-off, the transverse tarsal joint unlocks.
4) At toe-off, the gastroc-soleus complex is eccentric contracting.

Discussion

Because gait cycle questions are common on examinations, remember the following points:

- Stance phase: 62% of cycle
- Swing phase: 38% of cycle

Muscle firing

Electromyography findings during gait cycle:

	Muscle	**Activity**
Heel strike	Anterior tibialis Gastroc-soleus	Eccentric contraction Quiet
Foot flat	Anterior tibialis Gastroc-soleus	Quiet Eccentric contraction
Heel-off	Gastroc-soleus	Concentric contraction
Toe-off	Gastroc-soleus	Concentric contraction

Subtalar joint

- Heel strike to foot flat: Three important points
  - Eversion of the subtalar joint
  - Unlocking of the transverse tarsal joint
  - Internal rotation of the tibia
- Heel rise to toe-off
  - Inversion of the subtalar joint
  - Locking of the transverse tarsal joint
  - External rotation of the tibia

Correct Answer: From heel rise to toe-off, the tibia goes into external rotation.

1220. (3119) Q3-3630:

Which of the following statements describes the subtalar joint during walking:

1) Heel strike to toe-off: Internal rotation of the tibia
3) Heel strike to toe-off: Eversion of the subtalar joint
2) Heel strike to toe-off: Unlocking if transverse tarsal joint
5) Heel rise to toe-off: Locking of the transverse tarsal joint
4) Heel rise to toe-off: Eversion of the subtalar joint

Discussion

Because gait cycle questions are common on examinations, remember these points:

- Stance phase: 62% of cycle
- Swing phase: 38% of cycle

Muscle firing

Electromyography findings during gait cycle:

	Muscle	**Activity**
Heel strike	Anterior tibialis Gastroc-soleus	Eccentric contraction Quiet
Foot flat	Anterior tibialis Gastroc-soleus	Quiet Eccentric contraction
Heel-off	Gastroc-soleus	Concentric contraction
Toe-off	Gastroc-soleus	Concentric contraction

Subtalar joint

- Heel strike to foot flat: Three important points
    - Eversion of the subtalar joint
    - Unlocking of the transverse tarsal joint
    - Internal rotation of the tibia
- Heel rise to toe-off
    - Inversion of the subtalar joint
    - Locking of the transverse tarsal joint
    - External rotation of the tibia

Correct Answer: Heel rise to toe-off: Locking of the transverse tarsal joint

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1221. (3120) Q3-3631:

Which of the following tendons is the main inverter of the hind foot:

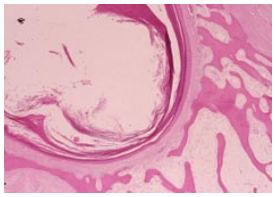
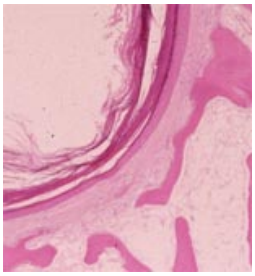
1) Peroneus longus tendon
3) Flexor hallucis longus tendon
2) Peroneus brevis tendon
5) Posterior tibial tendon
4) Flexor digitorum longus tendon

p class="subHeader"> Discussion

The posterior tibial tendon is the main inverter of the hindfoot. To conduct a sensitive test for posterior tibial tendon function, ask a patient to perform a single leg rise and observe if the hindfoot inverts. Patients with no posterior tibial tendon function are unable to invert the hindfoot on single leg rise.

Correct Answer: Posterior tibial tendon

1222. (3121) Q3-3634:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 35-year-old woman has a swollen and painful small toe. The radiographs of her foot are shown in Slides 1 and 2, and biopsy specimens in Slides 3 and 4. The most likely diagnosis is:

1) Enchondroma
3) Chondromyxoid fibroma
2) Plasmacytoma
5) Epidermoid inclusion cyst
4) Chondroblastoma

The radiographs show an expansile, lytic destructive lesion, which has replaced the distal and middle phalanxes of the little toe. The biopsy specimen shows the squamous epithelium of the skin with keratin production extending into the medullary cavity of the bone. The patient has an epidermoid inclusion cyst. These cysts are usually secondary to trauma. The treatment should be curettage and grafting.Correct Answer: Epidermoid inclusion cyst

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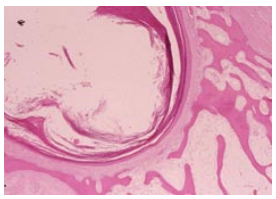
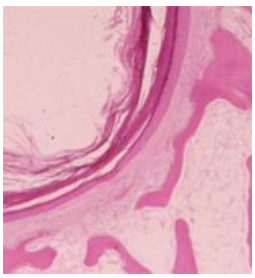
1223. (3122) Q3-3635:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 35-year-old woman has a swollen and painful small toe. The radiographs of her foot are shown in Slides 1 and 2, and biopsy specimens are shown in Slides 3 and 4. The most appropriate treatment would be:

1) Curettage with or without grafting
3) External beam irradiation
2) Toe amputation
5) Toe amputation and chemotherapy
4) Curettage and external beam irradiation

The radiographs show an expansile, lytic destructive lesion, which has replaced the distal and middle phalanxes of the little toe. The biopsy specimen shows the squamous epithelium of the skin with keratin production extending into the medullary cavity of the bone. The patient has an epidermoid inclusion cyst. These cysts are usually secondary to trauma. The treatment should be curettage and grafting.Correct Answer: Curettage with or without grafting

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1224. (3123) Q3-3636:

Which of the following statements about plantar fasciitis is true:

1) Occurs in men more often than in women
3) Normal thickness of the plantar fascia is 15 mm
2) Bilateral involvement is rare
5) Plantar fascia inserts at the base of the metatarsals
4) Plantar fascia supports the medial longitudinal arch

Discussion

Plantar fasciitis: General features

- Most common cause of heel pain
- Frequently occurs in athletes
- Men and women affected equally
- Symptoms are bilateral in 10% of patients
- Clinical findings
    - Pain on the bottom of the heel
    - Pain is worse with first steps in the morning
    - Pain is worse with weight bearing after sitting
    - Pain is worse with activities of daily living
    - Tenderness over the plantar fascia
    - Pain is worsened by dorsiflexion of the toes

Plantar fascia

- Broad, thick structure that originates from the medial calcaneal tuberosity and inserts on the plantar plates of the metatarsalphalangeal joints and proximal phalanges
- Supports the medial longitudinal arch
- Although the etiology of plantar fasciitis is not known, one theory is excessive stress on the plantar fascia causes micro tears
- Biopsies show fibroblastic proliferation and chronic granulomatous tissue
- The fascia can be as thick as 15 mm (3 mm is normal)

Correct Answer: Plantar fascia supports the medial longitudinal arch

1225. (3124) Q3-3637:

Which of the following statements describes the results of extracorporeal shock wave therapy for chronic plantar fasciitis:

1) No improvement in pain scores occurred at 4 or 12 weeks.
3) Pain scores significantly improved at 4 and 12 weeks.
2) No improvement in pain scores occurred at 4 weeks, but significant improvement occurred at 12 weeks.
5) Although pain scores improved, less than 50% of the patients were satisfied.
4) Pain scores improved, but function did not improve.

Discussion

In a recent study in *Orthopaedics*, Furia showed that a significant improvement in pain and function scores occurred in patients who had plantar fasciitis treated with extracorporeal shock wave therapy. Approximately 80% of the patients were satisfied with the treatment and would have the shock wave treatment again.

Results

Pain Visual Analog Scale (VAS)

- Pre-treatment VAS — 9.2 standard deviation (SD) 0.7
- Post-treatment VAS (4 weeks) — 3.4 SD 1.9 ($P<.05$)
- Post-treatment VAS (12 weeks) — 2.4 SD dev 1.8 ($P<.05$)

RAND Score Physical functioning

- Pre-treatment — 40.4 SD 1.3
- Post-treatment (4 weeks) — 91.5 SD 11.5 ($P<.05$)
- Post-treatment (12 weeks) — 91.5 SD 10.6 ($P<.05$)

RAND Score Pain

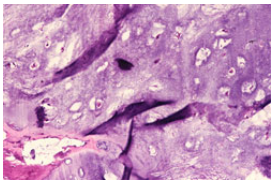
- Pre-treatment — 3.3 SD dev 1.1
- Post-treatment (4 weeks) — 88.6 SD 16 ($P<.05$)
- Post-treatment (12 weeks) — 90.0 SD 11.6 ($P<.05$)

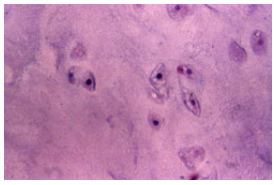
Patient satisfaction

- At 4 and 12 weeks post treatment, 49 (82%) patients were satisfied, and all patients would undergo the procedure again.

Correct Answer: Pain scores significantly improved at 4 and 12 weeks.

1226. (3125) Q3-3638:





Slide 1 **Slide 2** **Slide 3**

A 40-year-old man has pain in his foot after minor trauma. A radiograph is shown in Slide 1 and biopsy specimens are shown in Slides 2 and 3. The most likely diagnosis is:

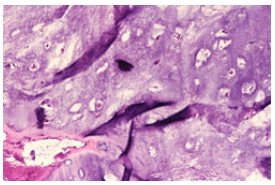
1) Low-grade chondrosarcoma
3) Enchondroma
2) High-grade chondrosarcoma
5) Chondromyxoid fibroma
4) Chondroblastoma

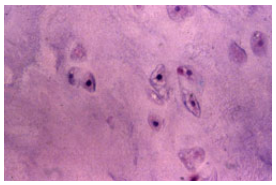
The radiograph shows a lucent lesion in the proximal phalanx of the second toe and expansion of the proximal phalanx. The bone is expanded with a thin periosteal rim. Faint calcifications are also seen within the medullary cavity. This radiographic appearance is characteristic of an enchondroma.

The low-power hematoxylin and eosin stain shows abundant blue hyaline matrix and a paucity of cells. The high-power hematoxylin and eosin stain shows the small dark and uniform nuclei present in enchondromas. No pleomorphism or nuclear atypia are present.

Correct Answer: Enchondroma

1227. (3126) Q3-3639:





Slide 1 **Slide 2** **Slide 3**

A 40-year-old man has pain in his foot after minor trauma. A radiograph is shown in Slide 1 and biopsy specimens are shown in Slides 2 and 3. Which of the following would be the most appropriate treatment:

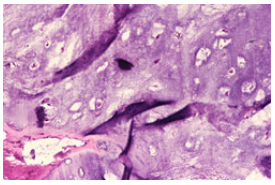
1) Curettage and bone grafting
3) Toe amputation
2) Wide resection and allograft reconstruction
5) Curettage, cement augmentation, and external beam irradiation
4) External beam irradiation

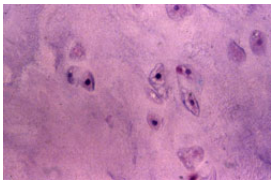
The radiograph shows a lucent lesion in the proximal phalanx of the second toe and expansion of the proximal phalanx. The bone is expanded with a thin periosteal rim. Faint calcifications are also seen within the medullary cavity. This radiographic appearance is fairly characteristic of an enchondroma.

The low-power hematoxylin and eosin stain shows abundant blue hyaline matrix and a paucity of cells. The high-power hematoxylin and eosin stain shows the small dark and uniform nuclei present in enchondromas. No pleomorphism or nuclear atypia are present.

Correct Answer: Curettage and bone grafting

1228. (3127) Q3-3640:





Slide 1 **Slide 2** **Slide 3**

A 40-year-old man has pain in his foot after minor trauma. A radiograph is shown in Slide 1 and biopsy specimens are shown in Slides 2 and 3. Which of the following best describes this condition:

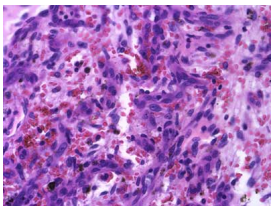
1) Benign bone tumor
3) High-grade malignant bone tumor
2) Low-grade malignant bone tumor
5) Metabolic condition
4) Benign reactive lesion (non-neoplastic)

The radiograph shows a lucent lesion in the proximal phalanx of the second toe and expansion of the proximal phalanx. The bone is expanded with a thin periosteal rim. Faint calcifications are also seen within the medullary cavity. This radiographic appearance is fairly characteristic of an enchondroma.

The low-power hematoxylin and eosin stain shows abundant blue hyaline matrix and a paucity of cells. The high-power hematoxylin and eosin stain shows the small dark and uniform nuclei present in enchondromas. No pleomorphism or nuclear atypia are present.

Correct Answer: Benign bone tumor

1229. (3128) Q3-3641:



Slide 1 **Slide 2** **Slide 3**

A 35-year-old man has experienced foot pain for 6 months. The anteroposterior and oblique radiographs are shown in Slides 1 and 2, and a biopsy specimen is shown in Slide 3. The most likely diagnosis is:

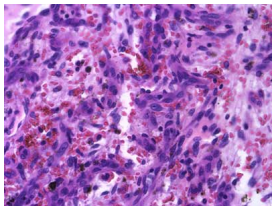
1) Metastatic adenocarcinoma
3) Eosinophilic granuloma (Langerhans cell histiocytosis)
2) Multiple myeloma
5) Hemangioendothelioma
4) Aneursymal bone cyst

The radiographs show lytic destructive lesions in the first and second metatarsals. Malignant vascular tumors, such as hemangioendothelioma, characteristically manifest as multiple lytic lesions in the same extremity in young patients.

The biopsy shows vasoformative cells, which are trying to form blood vessels. The correct diagnosis is hemangioendothelioma of bone, which is a low-grade malignancy with a low risk of pulmonary metastases. Patients are typically treated with external beam irradiation. This patient opted for below-knee amputation. He could have also been treated with irradiation.

Correct Answer: Hemangioendothelioma

1230. (3129) Q3-3642:



Slide 1 Slide 2 Slide 3

A 35-year-old man has foot pain for 6 months. The anteroposterior and oblique radiographs are shown in Slides 1 and 2, and a biopsy specimen is shown in Slide 3. Which of the following treatments is the most appropriate:

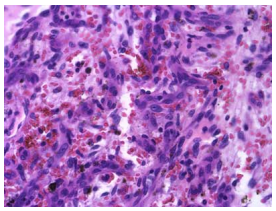
1) Preoperative chemotherapy and wide resection
3) Chemotherapy and external beam irradiation
2) Wide resection and external beam irradiation
5) External beam irradiation alone
4) Wide resection alone

The radiographs show lytic destructive lesions in the first and second metatarsals. Malignant vascular tumors, such as hemangioendothelioma, characteristically manifest as multiple lytic lesions in the same extremity in young patients.

The biopsy shows vasoformative cells, which are trying to form blood vessels. The correct diagnosis is hemangioendothelioma of bone, which is a low-grade malignancy with a low risk of pulmonary metastases. Patients are typically treated with external beam irradiation. This patient opted for below-knee amputation. He could have also been treated with irradiation.

Correct Answer: External beam irradiation alone

1231. (3130) Q3-3643:



Slide 1 Slide 2 Slide 3

A 35-year-old man has foot pain for 6 months. The anteroposterior and oblique radiographs are shown in Slides 1 and 2, and a biopsy specimen is shown in Slide 3. The etiology of this condition is most likely:

1) Benign neoplasm
3) High-grade malignant neoplasm
2) Low-grade malignant neoplasm
5) Infectious
4) Post-traumatic

The radiographs show lytic destructive lesions in the first and second metatarsals. Malignant vascular tumors, such as hemangioendothelioma, characteristically manifest as multiple lytic lesions in the same extremity in young patients.

The biopsy shows vasoformative cells, which are trying to form blood vessels. The correct diagnosis is hemangioendothelioma of bone, which is a low-grade malignancy with a low risk of pulmonary metastases. Patients are typically treated with external beam irradiation. This patient opted for below-knee amputation. He could have also been treated with irradiation.

Correct Answer: Low-grade malignant neoplasm

1232. (3131) Q3-3847:

Which of the following medications is an effective alternative to intravenous vancomycin for the treatment of severe soft tissue infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA):

1) Ciprofloxacin
3) Linezolid
2) Dicloxacillin
5) Clindamycin
4) Gentamicin

Oral linezolid (600 mg twice a day) is an effective oral alternative to intravenous vancomycin. Below is a summary of a recent prospective, randomized study showing the efficacy of linezolid.

Staphylococcus aureus complicates soft tissue and skin infections. Approximately 30% of *S aureus* infections are methicillin-resistant. Although vancomycin has been the treatment of choice for MRSA, linezolid inhibits bacterial protein synthesis by blocking formation of the 70S initiation complex and can be administered orally, which is an advantage over vancomycin.

This is a single-center study of adult patients. Investigators randomized 60 patients with *S aureus* (culture proven) to intravenous vancomycin or oral linezolid. The median length of therapy was 10 days. Seven patients in the vancomycin group required amputation, whereas no amputations were performed in the linezolid group. The median length of hospital stay was shorter in the linezolid group, and outpatient therapy was $100 per day less expensive (approximately $6,500 was saved on the hospital stay). A higher clinical cure rate (94%) was reported with the linezolid group compared to 84% with vancomycin.

Linezolid is given orally, 600 mg every 12 hours, and it is well tolerated. No adverse effects were reported in this study. Other studies have had similar results. This is an important study for orthopedic surgeons because the number of patients presenting with MRSA infections is increasing. Athletes may be at an increased risk for the infection because of the potential for spread in locker rooms. This can be a limb-threatening infection and must be taken seriously.

Correct Answer: Linezolid

1233. (3132) Q3-3848:

The mechanism of action of linezolid is:

1) Inhibition of cell wall synthesis
3) Inhibition of deoxyribonucleic acid synthesis
2) Inhibition of ribonucleic acid synthesis
5) Inhibition of protein prehylation
4) Inhibition of the 70S initiation complex

Oral linezolid (600 mg twice a day) is an effective oral alternative to intravenous vancomycin. Below is a summary of a recent prospective, randomized study showing the efficacy of linezolid.

Staphylococcus aureus complicates soft tissue and skin infections. Approximately 30% of *S aureus* infections are methicillin-resistant. Although vancomycin has been the treatment of choice for methicillin-resistant *S aureus* (MRSA), linezolid inhibits bacterial protein synthesis by blocking formation of the 70S initiation complex and can be administered orally, which is an advantage over vancomycin.

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Linezolid is given orally, 600 mg every 12 hours, and it is well tolerated. No adverse effects were reported in this study. Other studies have had similar results. This is an important study for orthopedic surgeons because the number of patients presenting with MRSA infections is increasing. Athletes may be at an increased risk for the infection because of the potential for spread in locker rooms. This can be a limb-threatening infection and must be taken seriously.

Correct Answer: Inhibition of the 70S initiation complex

1234. (3133) Q3-3850:

A 25-year-old minor league baseball player has a severe soft tissue infection on the sole of his foot. The infection has not responded to oral cephalexin. There is 4 cm of surrounding erythema and induration, and a small amount of exudate can be expressed. The most likely organism is:

1) *Streptococcus*
3) Methicillin-resistant *S aureus* (MRSA)
2) *Staphyloccus aureus*
5) *Enteroccocus*
4) *Corynebacterium*

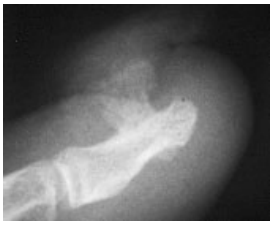
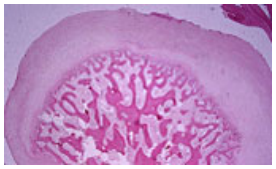
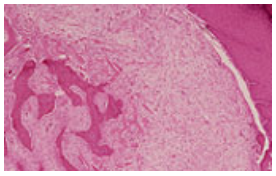
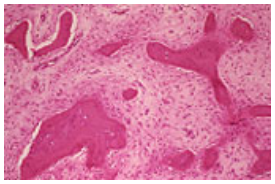
Staphylococcus aureus complicates soft tissue and skin infections. Approximately 30% of *S aureus* infections are methicillin-resistant. Although vancomycin has been the treatment of choice for MRSA, linezolid inhibits bacterial protein synthesis by blocking formation of the 70S initiation complex and can be administered orally, which is an advantage over vancomycin.

This is a single-center study of adult patients. Investigators randomized 60 patients with *S aureus* (culture proven) to intravenous vancomycin or oral linezolid. The median length of therapy was 10 days. Seven patients in the vancomycin group required amputation, whereas no amputations were performed in the linezolid group. The median length of hospital stay was shorter in the linezolid group, and outpatient therapy was $100 per day less expensive (approximately $6,500 was saved on the hospital stay). A higher clinical cure rate (94%) was reported with the linezolid group compared to 84% with vancomycin.

Linezolid is given orally, 600 mg every 12 hours, and it is well tolerated. No adverse effects were reported in this study. Other studies have had similar results. This is an important study for orthopedic surgeons because the number of patients presenting with MRSA infections is increasing. Athletes may be at an increased risk for the infection because of the potential for spread in locker rooms. This can be a limb-threatening infection and must be taken seriously.

Correct Answer: Methicillin-resistant *S aureus* (MRSA)

1235. (3134) Q3-3851:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 15-year-old boy has a large mass underneath the toenail of his great toe. His nail is raised and ulceration is present. The plain radiograph is shown in Slide 1, and biopsy specimens are shown in Slides 2, 3, and 4. The most likely diagnosis is:

1) Low-grade osteosarcoma
3) Fibrosarcoma
2) High-grade osteosarcoma
5) Subungual exostosis
4) Parosteal osteosarcoma

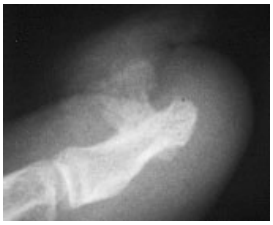
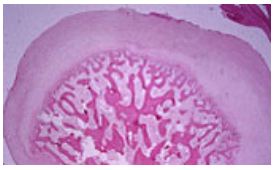
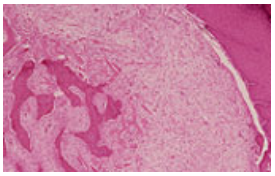
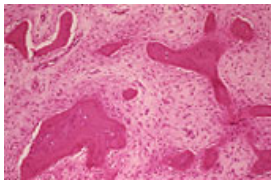
The plain radiograph shows a large bone lesion arising from the dorsal surface of the distal phalanx. This radiographic appearance is characteristic of a subungual exostosis. Osteochondromas do not occur in the distal phalanx, and there is no communication between the lesion and the medullary cavity.

The biopsy specimens show the new bone formation and a fibroblastic stroma, which can be confused with osteosarcoma.

The diagnosis is subungual exostosis and the treatment is simple excision.

Correct Answer: Subungual exostosis

1236. (3135) Q3-3852:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 15-year-old boy has a large mass underneath the toenail of his great toe. His nail is raised and ulceration is present. The plain radiograph is shown in Slide 1, and biopsy specimens are shown in Slides 2, 3, and 4. Which of the following is the best form of treatment:

1) Toe amputation
3) External beam irradiation
2) Preoperative chemotherapy followed by toe amputation
5) Simple excision
4) External beam irradiation and chemotherapy

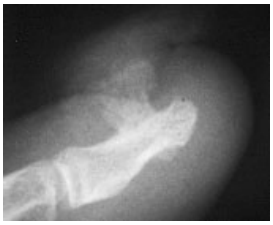
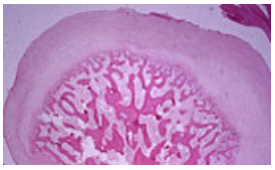
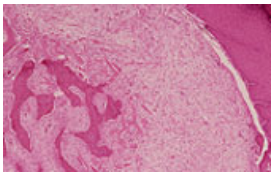
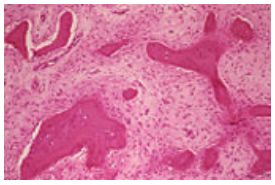
The plain radiograph shows a large bone lesion arising from the dorsal surface of the distal phalanx. This radiographic appearance is characteristic of a subungual exostosis. Osteochondromas do not occur in the distal phalanx, and there is no communication between the lesion and the medullary cavity.

The biopsy specimens show the new bone formation and a fibroblastic stroma, which can be confused with osteosarcoma.

The diagnosis is subungual exostosis and the treatment is simple excision.

Correct Answer: Simple excision

1237. (3136) Q3-3853:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 15-year-old boy has a large mass underneath the toenail of his great toe. His nail is raised and ulceration is present. The plain radiograph is shown in Slide 1, and biopsy specimens are shown in Slides 2, 3, and 4. Which of the following best describes this condition:

1) Low-grade malignancy
3) Inactive benign neoplasm
2) High-grade malignancy
5) Benign reactive condition (non-neoplastic)
4) Aggressive benign neoplasm

The plain radiograph shows a large bone lesion arising from the dorsal surface of the distal phalanx. This radiographic appearance is characteristic of a subungual exostosis. Osteochondromas do not occur in the distal phalanx, and there is no communication between the lesion and the medullary cavity.

The biopsy specimens show the new bone formation and a fibroblastic stroma, which can be confused with osteosarcoma.

The diagnosis is subungual exostosis and the treatment is simple excision.

Correct Answer: Benign reactive condition (non-neoplastic)

1238. (3192) Q3-4011:

Deep infection following open reduction internal fixation (ORIF) for tibial pilon fractures is most commonly associated with:

1) Open fractures
3) Anterior incision
2) Postoperative wound dehiscence
5) Low energy injury
4) Medial and lateral plating

Deep infection following ORIF of pilon fractures is correlated with postoperative wound dehiscence or skin slough but not with the presence of an open fracture in a series of 60 pilon fractures treated by ORIF.Correct Answer: Postoperative wound dehiscence

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1239. (3193) Q3-4012:

Polyglycolide screws used for fixation of ankle fractures:

1) Are associated with a higher rate of sterile effusion than polylactide screws
3) Are not associated with sterile effusion
2) Are associated with a lower rate of sterile effusion than polylactide screws
5) Do not resorb over time
4) Provide more rigid fixation than polylactide screws

Polyglycolide screws have a high incidence of sterile effusions as a result of rapid hydrolysis; polylactide screws showed no soft tissue reactions.Correct Answer: Are associated with a higher rate of sterile effusion than polylactide screws

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1240. (3194) Q3-4014:

The most effective fixation technique that will ensure adequate visualization (imaging) of avascular necrosis changes following talar neck fracture is:

1) Fixation with 0.062-inch K-wires
3) Fixation with stainless steel mini-fragment screws
2) Closed reduction
5) Fixation with a stainless steel locking plate
4) Fixation with titanium screws

High-quality magnetic resonance images of the talus can consistently be obtained in the presence of titanium screws in contrast to images obtained with stainless steel implants. Magnetic resonance imaging is better than plain radiographs at assessing the volume of talar avascular necrosis.Correct Answer: Fixation with titanium screws

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1241. (3195) Q3-4015:

Treatment of significant loss of height and posttraumatic arthritis following nonoperative treatment of calcaneus fractures should include:

1) Subtalar distraction bone block arthrodesis
3) Tibiotalocalcaneal arthrodesis
2) Corrective osteotomy
5) Custom orthotics with lateral heel posting
4) Custom Arizona ankle brace with heel lift

Management of late loss of height following calcaneus fracture is best addressed by a distraction arthrodesis of the subtalar joint using a wedge-shaped structural bone graft.Correct Answer: Subtalar distraction bone block arthrodesis

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1242. (3196) Q3-4016:

Incisions made through blood-filled fracture blisters have:

1) A lower risk of wound healing problems than clear fluid-filled fracture blisters
3) The same ability to heal as clear fluid-filled fracture blisters
2) No increased risk of wound healing problems than through normal skin
5) Should be left open to heal by secondary intention
4) A higher risk of wound healing problems than clear fluid-filled fracture blisters

Biopsies of the edge of fracture blisters following ankle fracture show that blood-filled blisters represent a deeper injury than clear fluid-filled blisters. The dermis of clear blisters still showed some epithelial cells remaining, while the dermis of blood blisters showed no epithelial cells. Therefore, blood-filled blisters are more difficult to heal.Correct Answer: A higher risk of wound healing problems than clear fluid-filled fracture blisters

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1243. (3197) Q3-4017:

The plantar ecchymosis sign is:

1) An indication of possible compartment syndrome
3) An indication of possible Lisfranc fracture or sprain
2) An indication of possible compartment syndrome
5) Requires immediate fasciotomy
4) Described as a sign of plantar fascia rupture

The plantar ecchymosis sign is described as an ecchymotic area on the plantar midfoot that is indicative of possible injury to the plantar tarsometatarsal ligaments.Correct Answer: An indication of possible Lisfranc fracture or sprain

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1244. (3198) Q3-4018:

The joint contact area of the second tarsometatarsal joint after Lisfranc dislocation diminishes the greatest with:

1) Dorsolateral subluxation of the second metatarsal
3) Lateral subluxation of the second metatarsal
2) Dorsal subluxation of the second metatarsal
5) Plantar subluxation of the second metatarsal
4) Medial subluxation of the second metatarsal

Minor degrees of displacement not apparent on plain radiographs lead to significant decrease in the contact area of the second tarsometatarsal joint. Dorsolateral subluxation of the second tarsometatarsal joint suffers a loss of contact area more severely than pure dorsal or lateral subluxation. Just 3 mm of dorsolateral subluxation causes a 38% loss of contact area.Correct Answer: Dorsolateral subluxation of the second metatarsal

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1245. (3199) Q3-4019:

The âfleck signâ in midfoot injuries is a result of avulsion of the:

1) Lisfranc ligament that extends from the first metatarsal base to the second metatarsal base
3) Lisfranc ligament that extends from the medial cuneiform to the first metatarsal base
2) Lisfranc ligament that extends from the middle cuneiform to the first metatarsal base
5) Lisfranc ligament that extends from the lateral cuneiform to the third metatarsal base
4) Lisfranc ligament that extends from the medial cuneiform to the second metatarsal base

The âfleck signâ was described as an avulsion of the ligament that runs from the medial cuneiform to the base of the second metatarsal, the so-called Lisfranc ligament. It is considered pathognomonic for a tarsometatarsal injury.Correct Answer: Lisfranc ligament that extends from the medial cuneiform to the second metatarsal base

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1246. (3200) Q3-4020:

Delayed unions and nonunions of base of fifth metatarsal fractures have been demonstrated to heal by:

1) Prolonged cast immobilization and non-weight bearing
3) Continued use of a fracture boot with protected weight- bearing
2) Pulsed electromagnetic fields
5) Rigid carbon fiber shoe inserts
4) Injection of demineralized bone matrix

Nine delayed unions and nonunions of the proximal fifth metatarsal were treated with pulsed electromagnetic fields. All fractures healed in a mean of 4 months (follow-up 39 months, no refractures).Correct Answer: Pulsed electromagnetic fields

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1247. (3201) Q3-4021:

The main blood supply to the talar body is from the:

1) Peroneal artery
3) Artery of the tarsal canal
2) Dorsalis pedis artery
5) 1st dorsal metatarsal artery
4) Artery of the sinus tarsi

The main blood supply to the body of the talus is the artery of the tarsal canal, which is a branch off the posterior tibial artery. The dorsalis pedis and the artery of the sinus tarsi supply the talar head.Correct Answer: Artery of the tarsal canal

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1248. (3202) Q3-4022:

The strongest hardware configuration for fixation of talar neck fractures is:

1) Two crossed screws from distal to proximal
3) One large screw from posterior to anterior
2) Two parallel screws inserted from distal to proximal
5) One oblique screw from distal to proximal
4) Two parallel screws from posterior to anterior

Biomechanical cadaveric testing of several screw configurations showed two parallel screws from proximal to distal as the strongest fixation. The screws can be inserted either open or percutaneously. All screw configurations were stronger than K-wire configurations.Correct Answer: Two parallel screws from posterior to anterior

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1249. (3203) Q3-4023:

The maximal joint reactive force in the ankle is approximately:

1) Two times body weight
3) Five times body weight
2) Three times body weight
5) Eight times body weight
4) Seven times body weight

Stauffer and colleagues quantified ankle joint reactive force to be approximately 5 times body weight. This is a significant concern for prosthetic ankle arthroplasty because the implant surface area is relatively small over which these forces must be spread out.Correct Answer: Five times body weight

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1250. (3204) Q3-4024:

According to Sandersâ computed tomography (CT) classification for calcaneus fractures, a Sanders III fracture has:

1) One fracture line in the posterior facet
3) Three fracture lines in the posterior facet
2) Two fracture lines in the posterior facet
5) Five fracture lines in the posterior facet
4) Four fracture lines in the posterior facet

The Sanders CT classification is determined on coronal CT scans of the calcaneus at the level where the posterior facet is widest. A Sanders I is a nondisplaced fracture; Sanders II consists of a single fracture line splitting the posterior facet into two main fragments; Sanders III has two fracture lines with three main posterior facet fragments; and a Sanders IV has four or more articular fragments present.Correct Answer: Two fracture lines in the posterior facet

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1251. (4058) Q3-4025:

The incidence of compartment syndrome following calcaneus fracture is:

1) 5%
3) 15%
2) 10%
5) 30%
4) 20%

In a review article by Myerson, compartment syndrome was described to occur in 10% of calcaneal fractures. Of these, half will develop clawing, stiffness, or neurologic dysfunction. Diagnosis is confirmed by multistick invasive catheterization, especially the calcaneal compartment.Correct Answer: 10%

1252. (3205) Q3-4026:

Posterior antiglide plating of AO type B lateral malleolar fractures may be associated with:

1) Early loss of fixation
3) Syndesmotic irritation
2) Greater wound healing complications
5) Greater risk for nonunion
4) Peroneal tendonitis or peroneal tendon lesions

Posterior antiglide plating is associated with an increased need for hardware removal (43%) and an increased incidence of peroneal tendon lesions. The highest risk for peroneal tendon lesions was with distal placement of the plate and a protruding screw head in the most distal hole.Correct Answer: Peroneal tendonitis or peroneal tendon lesions

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1253. (3206) Q3-4027:

Displaced talar neck fractures should be treated:

1) Emergently within 6 hours to minimize the risk of avascular necrosis
3) There is no correlation between emergent or urgent fixation of talar neck fractures and risk of talar avascular necrosis.
2) Urgently within 1 day to minimize the risk of avascular necrosis
5) Emergently within 3 hours of injury
4) Emergently within 1 hour of injury

A retrospective review of 102 talar neck fractures that underwent open reduction internal fixation showed no decrease in the development of osteonecrosis in fractures that were treated earlier. The mean time to fixation was 3.4 days for patients who had development of osteonecrosis, compared with 5 days for patients who did not have development of osteonecrosis.Correct Answer: There is no correlation between emergent or urgent fixation of talar neck fractures and risk of talar avascular necrosis.

1254. (3207) Q3-4028:

How many weeks following open reduction and internal fixation of a right ankle fracture can patients resume driving with normal braking times:

1) 6 weeks
3) 12 weeks
2) 9 weeks
5) 18 weeks
4) 16 weeks

Total braking time following open reduction and internal fixation of right ankle fractures was tested at 6, 9, and 12 weeks postoperatively. These patients were managed with a functional brace, non-weight bearing, and early range of motion in the postoperative period. Braking time was significantly slower than normal at 6 weeks, but had returned to near normal by 9 weeks postoperatively.Correct Answer: 9 weeks

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1255. (3208) Q3-4029:

Time to radiographic fusion following arthroscopic ankle arthrodesis is:

1) Longer than following an open technique arthrodesis
3) The same as open technique
2) Shorter than following an open technique arthrodesis
5) Is affected by whether two-screw or three-screw fixation is utilized
4) Is affected by whether external bone stimulation is utilized

Time to radiographic fusion following arthroscopic ankle arthrodesis is shorter than following open ankle arthrodesis. Theoretically, the decreased dissection and soft-tissue stripping contributes to greater vascular inflow to heal the fusion site.Correct Answer: Shorter than following an open technique arthrodesis

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1256. (3209) Q3-4030:

Superficial peroneal nerve injury following ankle fracture:

1) Does not occur with nonoperative treatment
3) Did not ultimately affect the final AOFAS ankle-hindfoot score
2) Can best be avoided during open reduction internal fixation with a posterolateral approach to the fibula
5) Can best be avoided during open reduction internal fixation with an anterolateral approach to the fibula
4) Occurs in fewer than 5% of operatively fixed fibula fractures

One hundred twenty patients with ankle fractures were evaluated. Symptomatic superficial peroneal nerve injury was identified in 21% of patients who underwent open reduction internal fixation and 9% of nonoperatively treated patients. AOFAS scores were decreased in patients with symptomatic superficial peroneal nerve injury. No injuries to the superficial peroneal nerve occurred in patients who underwent surgery involving a posterolateral approach to the fibula.Correct Answer: Can best be avoided during open reduction internal fixation with a posterolateral approach to the fibula

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1257. (3210) Q3-4031:

Which of the following is the most reliable way to determine that a deltoid ligament injury is associated with a Weber B level lateral malleolus fracture:

1) The presence of medial tenderness on clinical examination
3) The presence of significant medial swelling on clinical examination
2) The presence of medial ecchymosis on clinical examination
5) The presence of lateral malleolus tenderness
4) Evidence of medial clear space widening on stress radiographs

Weber B supination, external rotation ankle fractures were evaluated to determine the reliability of medial tenderness, ecchymosis, and swelling in predicting deltoid incompetence. These clinical signs were poorly predictive, and stress radiographs were recommended for an accurate diagnosis of instability.Correct Answer: Evidence of medial clear space widening on stress radiographs

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1258. (3211) Q3-4032:

The optimal position for ankle arthrodesis is:

1) 5° plantarflexion, 5° valgus, 5° external rotation
3) Neutral flexion, 0° varus/valgus, 5° external rotation
2) Neutral flexion, 5° valgus, 5° external rotation
5) 5° dorsiflexion, 5° valgus, 5° external rotation
4) Neutral flexion, 5° valgus, 5° internal rotation

The optimal position for ankle arthrodesis is neutral flexion, 5° valgus, and 5° external rotation. Historically, surgeons thought that women should be fused in some amount of equinus to better allow them to wear heeled shoes. However, this can increase the development of neighboring joint arthritis and also create a knee recurvatum deformity when ambulating barefoot. Currently it is recommended that all patients are fused in neutral dorsi-/plantarflexion.Correct Answer: Neutral flexion, 5° valgus, 5° external rotation

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1259. (3212) Q3-4033:

Varus malunion following talar neck fracture is best corrected by:

1) Subtalar arthrodesis
3) Deltoid ligament release and lateral ligament reconstruction
2) Rotational calcaneal osteotomy with a bone block
5) Lateral column lengthening
4) Talar neck osteotomy with lengthening or by triple arthrodesis

The best way to address varus malunion in talar neck fractures and maintain motion is by talar neck osteotomy. However, there is a further possible risk of talar avascular necrosis with this procedure. The other acceptable treatment is a triple arthrodesis, although this eliminates all hindfoot motion.Correct Answer: Talar neck osteotomy with lengthening or by triple arthrodesis

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1260. (3213) Q3-4034:

Neighboring joint arthritis following ankle arthrodesis has not been found in the:

1) Knee joint
3) First metatarsophalangeal joint
2) Naviculocuneiform joint
5) Hindfoot joint
4) Subtalar joint

Long-term follow-up of ankle fusions show that nearly all patients develop arthritis in the hindfoot, midfoot, and 1st metatarsophalangeal joint. There is no evidence to show that the hip or knee is at greater risk for developing arthritis following ankle fusion.Correct Answer: Knee joint

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1261. (3214) Q3-4035:

Following calcaneus fracture, risk factors for later need for subtalar arthrodesis due to painful posttraumatic arthritis include all of the following except:

1) Bohlerâs angle <0Â°
3) Workersâ compensation
2) Sanders type IV fractures
5) Female gender
4) Initial nonoperative care

Buckley conducted a series of large prospective studies following calcaneus fracture outcomes in Canada. All of the above factors were associated with the need for later subtalar fusion except female gender. In his other studies, it was demonstrated that male gender was a risk factor for not having a significantly better clinical outcome with surgery versus nonsurgical treatment.Correct Answer: Female gender

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1262. (3215) Q3-4036:

Range of motion following total ankle replacement is closely correlated with:

1) Amount of osteophytes resected during surgery
3) Level of tibial and talar saw cuts
2) Meticulous ligament balancing
5) Size of implant
4) Preoperative range of motion

A radiographic study comparing preoperative to postoperative tibio-talar range of motion as measured by radiographs showed that the amount of motion that patients had following ankle replacement was most dependent upon the motion they had before surgery.Correct Answer: Preoperative range of motion

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1263. (3216) Q3-4037:

Patients sustaining a crushing injury to the foot with midfoot tenderness but without any radiographic signs of fracture or dislocation:

1) Should be managed with a postoperative shoe and early physical therapy until the tenderness resolves
3) Should be protected in a cast boot with early weight bearing to tolerance
2) Should be splinted and kept non-weight bearing until nontender
5) Can be discharged with no further follow-up
4) Requires open reduction internal fixation to prevent long-term arthritis

Patients who sustain a foot injury and have clinical midfoot tenderness should be assumed to have a serious midfoot sprain until proven otherwise. These patients should be protected non-weight bearing until the tenderness is gone before weight-bearing and physical therapy begins.Correct Answer: Should be splinted and kept non-weight bearing until nontender

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1264. (3217) Q3-4038:

The distinguishing factor in a Hawkins type 4 talar neck fracture is:

1) The presence of an incongruent ankle joint
3) The presence of an incongruent subtalar joint
2) Incongruity of the ankle and/or subtalar joint with the presence of a talonavicular dislocation.
5) The presence of a posterior process of the talus fracture
4) The presence of an associated talar body fracture

Hawkins type 1 fractures are nondisplaced. Hawkins type 2 fractures have an incongruent subtalar joint. Hawkins type 3 fractures have an incongruent ankle and subtalar joint. Hawkins type 4 fractures have the above injuries and incongruent talo-navicular joint.Correct Answer: Incongruity of the ankle and/or subtalar joint with the presence of a talonavicular dislocation.

1265. (3218) Q3-4039:

The calcaneal compartment of the foot contains all of the following structures except:

1) Quadratus plantae muscle
3) Lateral plantar nerve, artery, and vein
2) Posterior tibial nerve, artery, and vein
5) 1st dorsal metatarsal artery
4) Interossei muscles

The four interossei muscles are contained in their respective interosseous compartments. The calcaneal compartment may also variably contain the medial plantar nerve. The remaining compartments of the foot are the adductor, medial, lateral, and superficial.Correct Answer: Interossei muscles

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1266. (3219) Q3-4040:

Gustilo-Anderson type I and type IIA open calcaneal fractures with a medial wound can be treated:

1) With initial washout and subsequent open reduction internal fixation with a lateral plate once the soft tissues and swelling have stabilized
3) With initial washout and late reconstruction once the soft tissue has healed to address the malunion
2) With initial washout and external fixation only due to the risk of osteomyelitis
5) With immediate fasciotomy
4) Washout is unnecessary for type I and IIA open calcaneal fractures

Forty-three open calcaneal fractures were studied, showing that open reduction internal fixation with plate and screws of type I and type IIA fractures with medial wounds had outcomes similar to closed injuries. Type IIIB open calcaneal fractures should undergo early flap coverage. Early internal fixation should be avoided in these injuries due to the high rates of osteomyelitis and amputation.Correct Answer: With initial washout and subsequent open reduction internal fixation with a lateral plate once the soft tissues and swelling have stabilized

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1267. (3220) Q3-4041:

Take-down of ankle arthrodesis and conversion to total ankle replacement:

1) Is impossible if the fibula has been resected
3) Has a poor clinical success rate if there is no clear underlying cause of pain from the ankle fusion
2) Is a dependable procedure with a rate of complications similar to primary ankle replacement
5) Requires custom made prosthetic implants
4) Results in minimal gains in ankle range of motion

This article studied the success rates of revising previous ankle fusions to ankle replacement. The authors found that if the etiology of a patientâs pain was unclear, the patients did poorly. Patients with prior fibula resection could still be revised to ankle replacement with allograft bone to support the lateral side of the implant. Range of motion following revision to arthroplasty was comparable to primary replacement.Correct Answer: Has a poor clinical success rate if there is no clear underlying cause of pain from the ankle fusion

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1268. (3221) Q3-4042:

The distinction between a Lauge-Hansen supination-external rotation III injury and a Lauge-Hansen supination-external rotation IV injury is:

1) A spiral oblique fracture of the lateral malleolus
3) Posteroinferior tibiofibular ligament (PITFL) disruption or posterior malleolus fracture
2) Anteroinferior tibiofibular ligament (AITFL) disruption
5) Anterior talo-fibular ligament disruption
4) Deltoid ligament disruption or medial malleolus fracture

The sequence of injury according to the Lauge-Hansen classification system in supination-external rotation injuries is AITFL disruption, spiral oblique fracture of the lateral malleolus, PITFL disruption or posterior malleolus fracture, and finally stage IV, which is a deltoid ligament disruption or medial malleolus fracture.Correct Answer: Deltoid ligament disruption or medial malleolus fracture

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1269. (3222) Q3-4043:

Development of hindfoot arthritis following total ankle replacement is seen in:

1) 0% of patients
3) 50% of patients
2) <25% of patients
5) >75% of patients
4) 75% of patients

Although it is felt that the retention of some degree of ankle motion with ankle replacement can help prevent the development of hindfoot arthritis, in a 9-year follow-up study nearly 25% of patients still had radiographic signs of arthritis.Correct Answer: <25% of patients

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1270. (3223) Q3-4044:

When using external fixation in the treatment of tibial pilon fractures, distal transfixation wires:

1) Should always traverse the distal tibia-fibula joint to get optimal fixation
3) Are not at risk for causing joint infection
2) Should remain >12.2 mm above the subchondral plate of the distal tibia
5) Cannot be olive wires because of a higher risk for pin-tract infection
4) Are least at risk for penetrating the joint capsule over the anterolateral aspect of the ankle

In cadaver specimens, the anterolateral capsular reflection of the ankle joint extended proximally the highest with an average of 9.3 mm and a maximum of 12.2 mm. There was a 100% communication between the distal tibia-fibula joint and the ankle joint.Correct Answer: Should remain >12.2 mm above the subchondral plate of the distal tibia

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1271. (3224) Q3-4045:

Clinical improvement following ankle distraction arthroplasty:

1) Typically reaches its maximal improvement by the end of 1 year
3) Can take up to 5 years to reach maximal improvement
2) Is accompanied by major gains in ankle range of motion
5) Is usually realized within the first month following removal of the frame
4) Is not accompanied by improvement in radiographic joint space

Distraction arthroplasty with an Ilizarov external fixator is usually associated with half of the clinical improvement occurring within the first year, and the other half happening over the next 5 years.Correct Answer: Can take up to 5 years to reach maximal improvement

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1272. (3225) Q3-4046:

Failure following supramalleolar osteotomy for ankle arthritis is associated with:

1) Inadequate correction and poor cartilage on initial arthroscopy
3) Early weight bearing postoperatively
2) Opening wedge supramalleolar osteotomy with bone graft
5) Use of internal fixation
4) Addition of a fibular osteotomy to the procedure

In their clinical series, Takakura and colleagues showed that inadequate correction and initial chondromalacia were predictors of poor outcome following supramalleolar osteotomy.Correct Answer: Inadequate correction and poor cartilage on initial arthroscopy

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1273. (3226) Q3-4047:

Isolated talonavicular fusion:

1) Decreases subtalar motion by 25%
3) Locks subtalar motion
2) Decreases subtalar motion by 50%
5) Decreases subtalar motion by 10%
4) Has no effect on subtalar motion

This cadaver study examined the motion that remained in the hindfoot joints following sequential immobilization of the talo-navicular, subtalar, and calcaneo-cuboid joints. Fixing the talo-navicular joint virtually locked all subtalar motion.Correct Answer: Locks subtalar motion

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1274. (3227) Q3-4048:

Following triple arthrodesis, ankle range of motion is:

1) Unaffected
3) Decreased
2) Increased
5) Increases initially, but then returns to preoperative levels
4) Improves over time

This clinical study following triple arthrodesis patients for 10 years showed a 27% loss of ankle plantarflexion but no loss of dorsiflexion.Correct Answer: Decreased

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1275. (3228) Q3-4049:

Triple arthrodesis is associated with:

1) Long-term clinical stability with respect to pain relief
3) Worse patient satisfaction when ankle arthritis is present
2) High rates of nonunion
5) No increased risk for ankle arthritis
4) Development of ankle arthritis over time

Saltzman and colleagues followed 67 patients who underwent triple arthrodesis at 44-year follow-up. Nearly all patients had ankle arthritis at final follow-up. Clinical relief of pain deteriorated over time between intermediate 25-year follow-up and 44-year follow-up in the same group of patients.Correct Answer: Development of ankle arthritis over time

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1276. (3229) Q3-4050:

Isolated subtalar arthrodesis:

1) Increases transverse tarsal joint over time
3) Decreased talonavicular joint motion but increases calcaneocuboid joint motion
2) Decreases talonavicular motion less than calcaneocuboid motion
5) Increases subtalar motion
4) Decreases talonavicular motion more than calcaneocuboid motion

Subtalar fusion decreased talonavicular motion more so than calcaneocuboid motion in this cadaver study. Isolated talonavicular fusion is the most influential of the hindfoot joints, locking hindfoot motion.Correct Answer: Decreases talonavicular motion more than calcaneocuboid motion

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1277. (3230) Q3-4051:

Isolated subtalar fusion:

1) Is not associated with development of ankle or transverse tarsal joint arthritis
3) Is associated only with development of ankle arthritis, but the transverse tarsal joints are spared
2) Is associated only with development of transverse joint arthritis, but the ankle joint is spared
5) Is associated with knee joint degenerative arthritis
4) Is associated with the development of both ankle and transverse tarsal joint arthritis

In 48 subtalar fusions followed for 5 years, 36% of patients developed ankle arthritis and 41% of patients developed transverse tarsal joint arthritis.Correct Answer: Is associated with the development of both ankle and transverse tarsal joint arthritis

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1278. (3231) Q3-4052:

Following anatomic open reduction and internal fixation of a Lisfranc fracture-dislocation:

1) Development of tarsometatarsal arthritis will not occur.
3) If tarsometatarsal arthritis develops, then subsequent arthrodesis is required.
2) Tarsometatarsal arthritis may still arise in approximately 25% of patients.
5) The screws should be routinely removed at 6 weeks.
4) The screws should be routinely removed at 12 weeks.

In a series of patients who underwent open reduction internal fixation of Lisfranc fracture dislocations, 25% of patients developed midfoot arthritis at final follow-up, but only half of these patients required eventual midfoot arthrodesis.Correct Answer: Tarsometatarsal arthritis may still arise in approximately 25% of patients.

1279. (3232) Q3-4053:

Which injury is likely to have a worse clinical outcome:

1) A purely ligamentous Lisfranc injury
2) A Lisfranc fracture-dislocation

Purely ligamentous Lisfranc injuries have a worse clinical outcome than injuries associated with bony fractures.Correct Answer: A purely ligamentous Lisfranc injury

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1280. (3233) Q3-4054:

Hallux rigidus is associated with:

1) Metatarsus primus elevatus
3) Long first metatarsal
2) First ray hypermobility
5) Bipartate sesamoid
4) Flat- or chevron-shaped metatarsal head

In a large series of patients with hallux rigidus, risk factors were evaluated. The only factor that had a positive correlation with having hallux rigidus was the radiographic shape of the 1st metatarsal head. Metatarsus primus elevatus, first ray hypermobility, or long first metatarsal head were not significantly associated with hallux rigidus.Correct Answer: Flat- or chevron-shaped metatarsal head

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1281. (3234) Q3-4055:

Currently recommended indications for surgical management of hallux rigidus with an arthrodesis include:

1) Positive axial grind test on preoperative clinical examination
3) Osteophytes over the dorsolateral head of the first metatarsal
2) >50% of the cartilage on the metatarsal head remaining
5) Normal first metatarsophalangeal joint motion
4) Osteophytes over the dorsal aspect of the proximal phalanx

Coughlin and colleagues recommend that when pain with axial grind testing of the metatarsophalangeal joint is present or >50% loss of articular cartilage occurs intraoperatively, then first metatarsophalangeal arthrodesis should be performed.Correct Answer: Positive axial grind test on preoperative clinical examination

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1282. (3235) Q3-4056:

A Moberg procedure for hallux rigidus is:

1) An oblique first metatarsal shortening osteotomy
3) A medial closing wedge osteotomy of the proximal phalanx
2) An ostectomy of the medial eminence of the metatarsal
5) A lateral closing wedge osteotomy of the proximal phalanx
4) A dorsal closing wedge osteotomy of the proximal phalanx

The Moberg procedure involves a dorsal closing wedge osteotomy of the proximal phalanx. This sets the hallux higher off the floor, allowing for easier toe-off with less dorsal impingement during gait.Correct Answer: A dorsal closing wedge osteotomy of the proximal phalanx

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1283. (3236) Q3-4057:

The optimal position for hallux interphalangeal joint arthrodesis is:

1) 5° to 10° of plantarflexion
3) Neutral flexion
2) 5° to 10° of dorsiflexion
5) 10° of valgus
4) Slight supination of the toe

The optimal position for hallux interphalangeal joint arthrodesis is 5Â° to 10Â° of plantarflexion, neutral varus-valgus, and neutral rotation. The plantarflexion helps the toe pad to contact the ground during gait.Correct Answer: 5° to 10° of plantarflexion

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1284. (3237) Q3-4058:

First metatarsophalangeal prosthetic joint replacements:

1) Significantly increase joint range of motion
3) Provide less pain relief than first metatarsophalangeal arthrodesis
2) Have less complications than first metatarsophalangeal arthrodesis
5) Provide greater pain relief than first metatarsophalangeal arthrodesis
4) Have not been found to undergo osteolysis or loosening

First metatarsophalangeal joint replacement in this prospective comparative study performed poorly compared to arthrodesis. Patients with arthroplasties had greater pain and little improvement in range of motion.Correct Answer: Provide less pain relief than first metatarsophalangeal arthrodesis

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1285. (3327) Q3-4183:

Deep infection following open reduction internal fixation (ORIF) for tibial pilon fractures is most commonly associated with:

1) Open fractures
3) Anterior incision
2) Postoperative wound dehiscence
5) Low energy injury
4) Medial and lateral plating

Deep infection following ORIF of pilon fractures is correlated with postoperative wound dehiscence or skin slough but not with the presence of an open fracture in a series of 60 pilon fractures treated by ORIF.Correct Answer: Postoperative wound dehiscence

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1286. (3328) Q3-4185:

Talar body fractures are best classified by a fracture line:

1) That extends superiorly into the trochlea
3) That extends inferiorly, posterior to the lateral process
2) That extends anywhere posterior to the talar neck
5) That extends into the talar head
4) That extends inferiorly, anterior to the lateral process

Talar neck and body fractures can be difficult to distinguish, especially when they extend superiorly into the anteromedial aspect of the trochlea. These two fractures have a different prognosis. The authors recommend classification of these fractures based on the inferior fracture line; if anterior to lateral process of the talus, then it is a neck fracture; if posterior to lateral process of the talus, then it is a body fracture.Correct Answer: That extends inferiorly, posterior to the lateral process

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1287. (4061) Q3-4186:

The most effective fixation technique that will ensure adequate visualization (imaging) of avascular necrosis changes following talar neck fracture is:

1) Fixation with 0.062-inch K-wires
3) Fixation with stainless steel mini-fragment screws
2) Closed reduction
5) Fixation with a stainless steel locking plate
4) Fixation with titanium screws

High-quality magnetic resonance images of the talus can consistently be obtained in the presence of titanium screws in contrast to images obtained with stainless steel implants. Magnetic resonance imaging is better than plain radiographs at assessing the volume of talar avascular necrosis.Correct Answer: Fixation with titanium screws

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1288. (3329) Q3-4189:

The plantar ecchymosis sign is:

1) An indication of possible compartment syndrome
3) An indication of possible Lisfranc fracture or sprain
2) Related to a specific bacterial infection
5) Requires immediate fasciotomy
4) Described as a sign of plantar fascia rupture

The plantar ecchymosis sign is described as an ecchymotic area on the plantar midfoot that is indicative of possible injury to the plantar tarsometatarsal ligaments.Correct Answer: An indication of possible Lisfranc fracture or sprain

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1289. (3330) Q3-4190:

The joint contact area of the second tarsometatarsal joint after Lisfranc dislocation diminishes the greatest with:

1) Dorsolateral subluxation
3) Lateral subluxation
2) Dorsal subluxation
5) Plantar subluxation
4) Medial subluxation

Minor degrees of displacement not apparent on plain radiographs lead to significant decrease in the contact area of the second tarsometatarsal joint. Dorsolateral subluxation of the second tarsometatarsal joint suffers a loss of contact area more severely than pure dorsal or lateral subluxation. Just 3 mm of dorsolateral subluxation causes a 38% loss of contact area.Correct Answer: Dorsolateral subluxation

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1290. (3331) Q3-4191:

The âfleck signâ in midfoot injuries is a result of avulsion of the:

1) Lisfranc ligament that extends from the first metatarsal base to the second metatarsal base
3) Lisfranc ligament that extends from the medial cuneiform to the first metatarsal base
2) Lisfranc ligament that extends from the middle cuneiform to the first metatarsal base
5) Lisfranc ligament that extends from the lateral cuneiform to the third metatarsal base
4) Lisfranc ligament that extends from the medial cuneiform to the second metatarsal base

The âfleck signâ was described as an avulsion of the ligament that runs from the medial cuneiform to the base of the second metatarsal, the so-called Lisfranc ligament. It is considered pathognomonic for a tarsometatarsal injury.Correct Answer: Lisfranc ligament that extends from the medial cuneiform to the second metatarsal base

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1291. (3332) Q3-4192:

Delayed unions and nonunions of base of fifth metatarsal fractures have been demonstrated to heal by:

1) Prolonged cast immobilization and non-weight bearing
3) Continued use of a fracture boot with protected weight-bearing
2) Pulsed electromagnetic fields
5) Rigid carbon fiber shoe inserts
4) Injection of demineralized bone matrix

Nine delayed unions and nonunions of the proximal fifth metatarsal were treated with pulsed electromagnetic fields. All fractures healed in a mean of 4 months (follow-up 39 months, no refractures).Correct Answer: Pulsed electromagnetic fields

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1292. (3333) Q3-4194:

The strongest hardware configuration for fixation of talar neck fractures is:

1) Two crossed screws from distal to proximal
3) One large screw from posterior to anterior
2) Two parallel screws inserted from distal to proximal
5) One oblique screw from distal to proximal
4) Two parallel screws from posterior to anterior

Biomechanical cadaveric testing of several screw configurations showed two parallel screws from proximal to distal as the strongest fixation. The screws can be inserted either open or percutaneously. All screw configurations were stronger than K-wire configurations.Correct Answer: Two parallel screws from posterior to anterior

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1293. (3334) Q3-4195:

According to Sandersâ computed tomography (CT) classification for calcaneus fractures, a Sanders III fracture has:

1) One fracture line in the posterior facet
3) Three fracture lines in the posterior facet
2) Two fracture lines in the posterior facet
5) Five fracture lines in the posterior facet
4) Three fracture lines in the posterior facet

The Sanders CT classification is determined on coronal CT scans of the calcaneus at the level where the posterior facet is widest. A Sanders I is a nondisplaced fracture; Sanders II consists of a single fracture line splitting the posterior facet into two main fragments; Sanders III has two fracture lines with three main posterior facet fragments; and a Sanders IV has four or more articular fragments present.Correct Answer: Two fracture lines in the posterior facet

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1294. (3335) Q3-4196:

The incidence of compartment syndrome following calcaneus fracture is:

1) 5%
3) 15%
2) 10%
5) 30%
4) 20%

In a review article by Myerson, compartment syndrome was described to occur in 10% of calcaneal fractures. Of these, half will develop clawing, stiffness, or neurologic dysfunction. Diagnosis is confirmed by multistick invasive catheterization, especially the calcaneal compartment.Correct Answer: 10%

1295. (3336) Q3-4197:

Posterior antiglide plating of AO type B lateral malleolar fractures may be associated with:

1) Early loss of fixation
3) Syndesmotic irritation
2) Greater wound healing complications
5) Greater risk for nonunion
4) Peroneal tendonitis or peroneal tendon lesions

Posterior antiglide plating is associated with an increased need for hardware removal (43%) and an increased incidence of peroneal tendon lesions. The highest risk for peroneal tendon lesions was with distal placement of the plate and a protruding screw head in the most distal hole.Correct Answer: Peroneal tendonitis or peroneal tendon lesions

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1296. (3337) Q3-4198:

Displaced talar neck fractures should be treated:

1) Emergently within 6 hours to minimize the risk of avascular necrosis
3) There is no correlation between emergent or urgent fixation of talar neck fractures and risk of talar avascular necrosis.
2) Urgently within 1 day to minimize the risk of avascular necrosis
5) Emergently within 3 hours of injury
4) Emergently within 1 hour of injury

A retrospective review of 102 talar neck fractures that underwent open reduction internal fixation showed no decrease in the development of osteonecrosis in fractures that were treated earlier. The mean time to fixation was 3.4 days for patients who had development of osteonecrosis, compared with 5 days for patients who did not have development of osteonecrosis.Correct Answer: There is no correlation between emergent or urgent fixation of talar neck fractures and risk of talar avascular necrosis.

1297. (3338) Q3-4200:

Superficial peroneal nerve injury following ankle fracture:

1) Does not occur with nonoperative treatment
3) Did not ultimately affect the final AOFAS ankle-hindfoot score
2) Can best be avoided during open reduction internal fixation with a posterolateral approach to the fibula
5) Can best be avoided during open reduction internal fixation with an anterolateral approach to the fibula
4) Occurs in fewer than 5% of operatively fixed fibula fractures

One hundred twenty patients with ankle fractures were evaluated. Symptomatic superficial peroneal nerve injury was identified in 21% of patients who underwent open reduction internal fixation and 9% of nonoperatively treated patients. AOFAS scores were decreased in patients with symptomatic superficial peroneal nerve injury. No injuries to the superficial peroneal nerve occurred in patients who underwent surgery involving a posterolateral approach to the fibula.Correct Answer: Can best be avoided during open reduction internal fixation with a posterolateral approach to the fibula

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1298. (3339) Q3-4201:

Which of the following is the most reliable way to determine that a deltoid ligament injury is associated with a Weber B level lateral malleolus fracture:

1) The presence of medial tenderness on clinical examination
3) The presence of significant medial swelling on clinical examination
2) The presence of medial ecchymosis on clinical examination
5) The presence of lateral malleolus tenderness
4) Evidence of medial clear space widening on stress radiographs

Weber B supination, external rotation ankle fractures were evaluated to determine the reliability of medial tenderness, ecchymosis, and swelling in predicting deltoid incompetence. These clinical signs were poorly predictive, and stress radiographs were recommended for an accurate diagnosis of instability.Correct Answer: Evidence of medial clear space widening on stress radiographs

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1299. (3340) Q3-4202:

Varus malunion following talar neck fracture is best corrected by:

1) Subtalar arthrodesis
3) Deltoid ligament release and lateral ligament reconstruction
2) Rotational calcaneal osteotomy with a bone block
5) Lateral column lengthening
4) Talar neck osteotomy with lengthening or by triple arthrodesis

The best way to address varus malunion in talar neck fractures and maintain motion is by talar neck osteotomy. However, there is a further possible risk of talar avascular necrosis with this procedure. The other acceptable treatment is a triple arthrodesis, although this eliminates all hindfoot motion.Correct Answer: Talar neck osteotomy with lengthening or by triple arthrodesis

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1300. (3341) Q3-4203:

Following calcaneus fracture, risk factors for later need for subtalar arthrodesis due to painful posttraumatic arthritis include all of the following except:

1) Bohlerâs angle <0Â°
3) Workersâ compensation
2) Sanders type IV fractures
5) Female gender
4) Initial nonoperative care

Buckley conducted a series of large prospective studies following calcaneus fracture outcomes in Canada. All of the above factors were associated with the need for later subtalar fusion except female gender. In his other studies, it was demonstrated that male gender was a risk factor for not having a significantly better clinical outcome with surgery versus nonsurgical treatment.Correct Answer: Female gender

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1301. (3342) Q3-4204:

Patients sustaining a crushing injury to the foot with midfoot tenderness but without any radiographic signs of fracture or dislocation:

1) Should be managed with a postoperative shoe and early physical therapy until the tenderness resolves
3) Should be protected in a cast boot with early weight bearing to tolerance
2) Should be splinted and kept non-weight bearing until nontender
5) Can be discharged with no further follow-up
4) Requires open reduction internal fixation to prevent long-term arthritis

Patients who sustain a foot injury and have clinical midfoot tenderness should be assumed to have a serious midfoot sprain until proven otherwise. These patients should be protected non-weight bearing until the tenderness is gone before weight-bearing and physical therapy begins.Correct Answer: Should be splinted and kept non-weight bearing until nontender

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1302. (3343) Q3-4206:

The calcaneal compartment of the foot contains all of the following structures except:

1) Quadratus plantae muscle
3) Lateral plantar nerve, artery, and vein
2) Posterior tibial nerve, artery, and vein
5) 1st dorsal metatarsal artery
4) Interossei muscles

The four interossei muscles are contained in their respective interosseous compartments. The calcaneal compartment may also variably contain the medial plantar nerve. The remaining compartments of the foot are the adductor, medial, lateral, and superficial.Correct Answer: Interossei muscles

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1303. (3344) Q3-4211:

Time to radiographic fusion following arthroscopic ankle arthrodesis is:

1) Longer than following an open technique arthrodesis
3) The same as open technique
2) Shorter than following an open technique arthrodesis
5) Is affected by whether two-screw or three-screw fixation is utilized
4) Is affected by whether external bone stimulation is utilized

Time to radiographic fusion following arthroscopic ankle arthrodesis is shorter than following open ankle arthrodesis. Theoretically, the decreased dissection and soft-tissue stripping contributes to greater vascular inflow to heal the fusion site.Correct Answer: Shorter than following an open technique arthrodesis

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1304. (3345) Q3-4213:

Neighboring joint arthritis following ankle arthrodesis has not been found in the:

1) Knee joint
3) First metatarsophalangeal joint
2) Naviculocuneiform joint
5) Hindfoot joint
4) Subtalar joint

Long-term follow-up of ankle fusions show that nearly all patients develop arthritis in the hindfoot, midfoot, and 1st metatarsophalangeal joint. There is no evidence to show that the hip or knee is at greater risk for developing arthritis following ankle fusion.Correct Answer: Knee joint

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1305. (3346) Q3-4214:

Range of motion following total ankle replacement is closely correlated with:

1) Amount of osteophytes resected during surgery
3) Level of tibial and talar saw cuts
2) Meticulous ligament balancing
5) Size of implant
4) Preoperative range of motion

A radiographic study comparing preoperative to postoperative tibio-talar range of motion as measured by radiographs showed that the amount of motion that patients had following ankle replacement was most dependent upon the motion they had before surgery.Correct Answer: Preoperative range of motion

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1306. (3347) Q3-4215:

Take-down of ankle arthrodesis and conversion to total ankle replacement:

1) Is impossible if the fibula has been resected
3) Has a poor clinical success rate if there is no clear underlying cause of pain from the ankle fusion
2) Is a dependable procedure with a rate of complications similar to primary ankle replacement
5) Requires custom made prosthetic implants
4) Results in minimal gains in ankle range of motion

This article studied the success rates of revising previous ankle fusions to ankle replacement. The authors found that if the etiology of a patientâs pain was unclear, the patients did poorly. Patients with prior fibula resection could still be revised to ankle replacement with allograft bone to support the lateral side of the implant. Range of motion following revision to arthroplasty was comparable to primary replacement.Correct Answer: Has a poor clinical success rate if there is no clear underlying cause of pain from the ankle fusion

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1307. (3348) Q3-4216:

Development of hindfoot arthritis following total ankle replacement is seen in:

1) 0% of patients
3) 50% of patients
2) <25% of patients
5) >75% of patients
4) 75% of patients

Although it is felt that the retention of some degree of ankle motion with ankle replacement can help prevent the development of hindfoot arthritis, in a 9-year follow-up study nearly 25% of patients still had radiographic signs of arthritis.Correct Answer: <25% of patients

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1308. (4062) Q3-4217:

Clinical improvement following ankle distraction arthroplasty:

1) Typically reaches its maximal improvement by the end of 1 year
3) Can take up to 5 years to reach maximal improvement
2) Is accompanied by major gains in ankle range of motion
5) Is usually realized within the first month following removal of the frame
4) Is not accompanied by improvement in radiographic joint space

Distraction arthroplasty with an Ilizarov external fixator is usually associated with half of the clinical improvement occurring within the first year, and the other half happening over the next 5 years.Correct Answer: Can take up to 5 years to reach maximal improvement

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1309. (3349) Q3-4222:

Isolated subtalar arthrodesis:

1) Increases transverse tarsal joint over time
3) Decreased talonavicular joint motion but increases calcaneocuboid joint motion
2) Decreases talonavicular motion less than calcaneocuboid motion
5) Increases subtalar motion
4) Decreases talonavicular motion more than calcaneocuboid motion

Subtalar fusion decreased talonavicular motion more so than calcaneocuboid motion in this cadaver study. Isolated talonavicular fusion is the most influential of the hindfoot joints, locking hindfoot motion.Correct Answer: Decreases talonavicular motion more than calcaneocuboid motion

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1310. (3350) Q3-4225:

Which injury is likely to have a worse clinical outcome:

1) A purely ligamentous Lisfranc injury
2) A Lisfranc fracture-dislocation

Purely ligamentous Lisfranc injuries have a worse clinical outcome than injuries associated with bony fractures.Correct Answer: A purely ligamentous Lisfranc injury

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1311. (3443) Q3-4368:

Currently recommended indications for surgical management of hallux rigidus with an arthrodesis include:

1) Positive axial grind test on preoperative clinical examination
3) Osteophytes over the dorsolateral head of the first metatarsal
2) >50% of the cartilage on the metatarsal head remaining
5) Normal first metatarsophalangeal joint motion
4) Osteophytes over the dorsal aspect of the proximal phalanx

Coughlin and colleagues recommend that when pain with axial grind testing of the metatarsophalangeal joint is present or >50% loss of articular cartilage occurs intraoperatively, then first metatarsophalangeal arthrodesis should be performed.Correct Answer: Positive axial grind test on preoperative clinical examination

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1312. (3452) Q3-4380:

The main blood supply to the talar body is from the:

1) Peroneal artery
3) Artery of the tarsal canal
2) Dorsalis pedis artery
5) 1st dorsal metatarsal artery
4) Artery of the sinus tarsi

The main blood supply to the body of the talus is the artery of the tarsal canal, which is a branch off the posterior tibial artery. The dorsalis pedis and the artery of the sinus tarsi supply the talar head.Correct Answer: Artery of the tarsal canal

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1313. (3460) Q3-4392:

How many weeks following open reduction and internal fixation of a right ankle fracture can patients resume driving with normal braking times:

1) 6 weeks
3) 12 weeks
2) 9 weeks
5) 18 weeks
4) 16 weeks

Total braking time following open reduction and internal fixation of right ankle fractures was tested at 6, 9, and 12 weeks postoperatively. These patients were managed with a functional brace, non-weight bearing, and early range of motion in the postoperative period. Braking time was significantly slower than normal at 6 weeks, but had returned to near normal by 9 weeks postoperatively.Correct Answer: 9 weeks

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1314. (3467) Q3-4404:

When using external fixation in the treatment of tibial pilon fractures, distal transfixation wires:

1) Should always traverse the distal tibia-fibula joint to get optimal fixation
3) Are not at risk for causing joint infection
2) Should remain >12.2 mm above the subchondral plate of the distal tibia
5) Cannot be olive wires because of a higher risk for pin-tract infection
4) Are least at risk for penetrating the joint capsule over the anterolateral aspect of the ankle

In cadaver specimens, the anterolateral capsular reflection of the ankle joint extended proximally the highest with an average of 9.3 mm and a maximum of 12.2 mm. There was a 100% communication between the distal tibia-fibula joint and the ankle joint.Correct Answer: Should remain >12.2 mm above the subchondral plate of the distal tibia

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1315. (3470) Q3-4407:

Treatment of significant loss of height and posttraumatic arthritis following nonoperative treatment of calcaneus fractures should include:

1) Subtalar distraction bone block arthrodesis
3) Tibiotalocalcaneal arthrodesis
2) Corrective osteotomy
5) Custom orthotics with lateral heel posting
4) Custom Arizona ankle brace with heel lift

Management of late loss of height following calcaneus fracture is best addressed by a distraction arthrodesis of the subtalar joint using a wedge-shaped structural bone graft.Correct Answer: Subtalar distraction bone block arthrodesis

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1316. (3471) Q3-4408:

Incisions made through blood-filled fracture blisters have:

1) A lower risk of wound healing problems than clear fluid-filled fracture blisters
3) The same ability to heal as clear fluid-filled fracture blisters
2) No increased risk of wound healing problems than through normal skin
5) Should be left open to heal by secondary intention
4) A higher risk of wound healing problems than clear fluid-filled fracture blisters

Biopsies of the edge of fracture blisters following ankle fracture show that blood-filled blisters represent a deeper injury than clear fluid-filled blisters. The dermis of clear blisters still showed some epithelial cells remaining, while the dermis of blood blisters showed no epithelial cells. Therefore, blood-filled blisters are more difficult to heal.Correct Answer: A higher risk of wound healing problems than clear fluid-filled fracture blisters

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1317. (3472) Q3-4409:

Following triple arthrodesis, ankle range of motion is:

1) Unaffected
3) Decreased
2) Increased
5) Increases initially, but then returns to preoperative levels
4) Improves over time

This clinical study following triple arthrodesis patients for 10 years showed a 27% loss of ankle plantarflexion but no loss of dorsiflexion.Correct Answer: Decreased

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1318. (3473) Q3-4410:

A Moberg procedure for hallux rigidus is:

1) An oblique first metatarsal shortening osteotomy
3) A medial closing wedge osteotomy of the proximal phalanx
2) An ostectomy of the medial eminence of the metatarsal
5) A lateral closing wedge osteotomy of the proximal phalanx
4) A dorsal closing wedge osteotomy of the proximal phalanx

The Moberg procedure involves a dorsal closing wedge osteotomy of the proximal phalanx. This sets the hallux higher off the floor, allowing for easier toe-off with less dorsal impingement during gait.Correct Answer: A dorsal closing wedge osteotomy of the proximal phalanx

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1319. (3475) Q3-4413:

The distinguishing factor in a Hawkins type 4 talar neck fracture is:

1) The presence of an incongruent ankle joint
3) The presence of an incongruent subtalar joint
2) The presence of a talonavicular dislocation
5) The presence of an associated talar body fracture
4) The presence of an associated talar body fracture

Hawkins type 1 fractures are nondisplaced. Hawkins type 2 fractures have an incongruent subtalar joint. Hawkins type 3 fractures have an incongruent ankle and subtalar joint. Hawkins type 4 fractures have the above injuries and incongruent talo-navicular joint.Correct Answer: The presence of a talonavicular dislocation

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1320. (3476) Q3-4414:

First metatarsophalangeal prosthetic joint replacements:

1) Significantly increase joint range of motion
3) Provide less pain relief than first metatarsophalangeal arthrodesis
2) Have less complications than first metatarsophalangeal arthrodesis
5) Provide greater pain relief than first metatarsophalangeal arthrodesis
4) Have not been found to undergo osteolysis or loosening

First metatarsophalangeal joint replacement in this prospective comparative study performed poorly compared to arthrodesis. Patients with arthroplasties had greater pain and little improvement in range of motion.Correct Answer: Provide less pain relief than first metatarsophalangeal arthrodesis

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1321. (3479) Q3-4418:

The optimal position for ankle arthrodesis is:

1) 5Â° plantarflexion, 5Â° valgus, 5Â° external rotation
3) Neutral flexion, 0Â° varus/valgus, 5Â° external rotation
2) Neutral flexion, 5Â° valgus, 5Â° external rotation
5) 5Â° dorsiflexion, 5Â° valgus, 5Â° external rotation
4) Neutral flexion, 5Â° valgus, 5Â° internal rotation

The optimal position for ankle arthrodesis is neutral flexion, 5Â° valgus, and 5Â° external rotation. Historically, surgeons thought that women should be fused in some amount of equinus to better allow them to wear heeled shoes. However, this can increase the development of neighboring joint arthritis and also create a knee recurvatum deformity when ambulating barefoot. Currently it is recommended that all patients are fused in neutral dorsi-/plantarflexion.Correct Answer: Neutral flexion, 5Â° valgus, 5Â° external rotation

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1322. (3480) Q3-4420:

Isolated talonavicular fusion:

1) Decreases subtalar motion by 25%
3) Locks subtalar motion
2) Decreases subtalar motion by 50%
5) Decreases subtalar motion by 10%
4) Has no effect on subtalar motion

This cadaver study examined the motion that remained in the hindfoot joints following sequential immobilization of the talo-navicular, subtalar, and calcaneo-cuboid joints. Fixing the talo-navicular joint virtually locked all subtalar motion.Correct Answer: Locks subtalar motion

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1323. (3481) Q3-4421:

The distinction between a Lauge-Hansen supination-external rotation III injury and a Lauge-Hansen supination-external rotation IV injury is:

1) A spiral oblique fracture of the lateral malleolus
3) Posteroinferior tibiofibular ligament (PITFL) disruption or posterior malleolus fracture
2) Anteroinferior tibiofibular ligament (AITFL) disruption
5) Anterior talo-fibular ligament disruption
4) Deltoid ligament disruption or medial malleolus fracture

The sequence of injury according to the Lauge-Hansen classification system in supination-external rotation injuries is AITFL disruption, spiral oblique fracture of the lateral malleolus, PITFL disruption or posterior malleolus fracture, and finally stage IV, which is a deltoid ligament disruption or medial malleolus fracture.Correct Answer: Deltoid ligament disruption or medial malleolus fracture

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1324. (3482) Q3-4422:

Isolated subtalar fusion:

1) Is not associated with development of ankle or transverse tarsal joint arthritis
3) Is associated only with development of ankle arthritis, but the transverse tarsal joints are spared
2) Is associated only with development of transverse joint arthritis, but the ankle joint is spared
5) Is associated with knee joint degenerative arthritis
4) Is associated with the development of both ankle and transverse tarsal joint arthritis

In 48 subtalar fusions followed for 5 years, 36% of patients developed ankle arthritis and 41% of patients developed transverse tarsal joint arthritis.Correct Answer: Is associated with the development of both ankle and transverse tarsal joint arthritis

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1325. (3488) Q3-4428:

The optimal position for hallux interphalangeal joint arthrodesis is:

1) 5Â° to 10Â° of plantarflexion
3) Neutral flexion
2) 5Â° to 10Â° of dorsiflexion
5) 10Â° of valgus
4) Slight supination of the toe

The optimal position for hallux interphalangeal joint arthrodesis is 5Â° to 10Â° of plantarflexion, neutral varus-valgus, and neutral rotation. The plantarflexion helps the toe pad to contact the ground during gait.Correct Answer: 5Â° to 10Â° of plantarflexion

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1326. (3501) Q3-4451:

Following anatomic open reduction and internal fixation of a Lisfranc fracture-dislocation:

1) Development of tarsometatarsal arthritis will not occur.
3) If tarsometatarsal arthritis develops, then subsequent arthrodesis is required.
2) Tarsometatarsal arthritis may still arise in approximately 25% of patients.
5) The screws should be routinely removed at 6 weeks.
4) The screws should be routinely removed at 12 weeks.

In a series of patients who underwent open reduction internal fixation of Lisfranc fracture dislocations, 25% of patients developed midfoot arthritis at final follow-up, but only half of these patients required eventual midfoot arthrodesis.Correct Answer: Tarsometatarsal arthritis may still arise in approximately 25% of patients.

1327. (3504) Q3-4455:

The maximal joint reactive force in the ankle is approximately:

1) Two times body weight
3) Five times body weight
2) Three times body weight
5) Eight times body weight
4) Seven times body weight

Stauffer and colleagues quantified ankle joint reactive force to be approximately 5 times body weight. This is a significant concern for prosthetic ankle arthroplasty because the implant surface area is relatively small over which these forces must be spread out.Correct Answer: Five times body weight

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1328. (3510) Q3-4462:

Hallux rigidus is associated with:

1) Metatarsus primus elevatus
3) Long first metatarsal
2) First ray hypermobility
5) Bipartate sesamoid
4) Flat- or chevron-shaped metatarsal head

In a large series of patients with hallux rigidus, risk factors were evaluated. The only factor that had a positive correlation with having hallux rigidus was the radiographic shape of the 1st metatarsal head. Metatarsus primus elevatus, first ray hypermobility, or long first metatarsal head were not significantly associated with hallux rigidus.Correct Answer: Flat- or chevron-shaped metatarsal head

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1329. (3742) Q3-7522:

Which nerve is NOT one of the terminal branches of Baxterâs nerve, also known as the first branch of the lateral plantar nerve:

1) Nerve to the medial calcaneal periosteum (sensory)
3) Nerve to the flexor digitorum brevis muscle (motor)
2) Lateral dorsal cutaneous nerve (sensory)
5) None of the above
4) Nerve to the abductor digiti minimi muscle (motor)

The three terminal branches of Baxterâs nerve are the nerve to the medial calcaneal periosteum, the nerve to the flexor digitorum brevis, and the nerve to the abductor digiti minimi. The lateral dorsal cutaneous nerve is a branch of the sural nerve.

Correct Answer: Lateral dorsal cutaneous nerve (sensory)

1330. (3814) Q3-7597:

A regimen of ankle bracing and supervised physical therapy:

1) Has no beneficial effect on stage II posterior tibial tendon dysfunction
3) Can significantly relieve pain and increase strength in stage II posterior tibial tendon dysfunction
2) Is helpful in relieving the pain symptoms associated with stage II posterior tibial tendon dysfunction but does not increase strength
5) Prevents patients from requiring surgery in only 11% of cases
4) Is only useful for postoperative rehabilitation after flexor digitorum longus tendon transfer and medial slide calcaneal osteotomy

In a study performed by Alvarez and colleagues, 47 patients with stage I or II posterior tibial tendon dysfunction were treated nonoperatively with either a hinged ankle-foot orthosis or foot orthosis and a supervised physical therapy program. After 10 therapy visits, 83% of patients had successful subjective and functional outcomes. Eighty-nine percent of patients were satisfied with the outcome of nonoperative treatment. This included significant improvement in visual analog scale scores and increased strength, concentrically and eccentrically. In this study, 11% of patients failed conservative treatment and required surgery.

Correct Answer: Can significantly relieve pain and increase strength in stage II posterior tibial tendon dysfunction

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1331. (3815) Q3-7598:

The use of hyperbaric oxygen (HBO) in the treatment of problematic diabetic foot wounds has been shown to do all of the following except:

1) To increase the healing rate
3) To be potentially cost-effective when the costs of long-term care of a nonhealing wound and limb amputation are considered
2) To decrease the amputation rate
5) To increase the juxta-wound pO2
4) To be ineffective in changing the outcome of diabetic foot wounds

A meta-analysis of 12 studies showed that healing rates increased from 48% to 76%, and amputation rates decreased from 45% to 19% with the use of hyperbaric oxygen (HBO) and local wound care. In randomized controlled trials, wound area decreased significantly and days to healing decreased significantly in patients treated with HBO. The juxta-wound pO2 was also significantly increased in the HBO-treatment group.

Correct Answer: To be ineffective in changing the outcome of diabetic foot wounds

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1332. (3816) Q3-7599:

The greatest insult to the vascular supply of the first metatarsal head during chevron bunionectomy with lateral release according to intraoperative laser Doppler blood flow measurements was:

1) During the lateral release
3) During the metatarsal osteotomy
2) During the adductor tenotomy
5) During skin incision
4) During the medial capsular release

Twenty patients were prospectively monitored with laser Doppler measurements of metatarsal head blood flow during chevron bunionectomy with lateral release. The greatest loss of blood flow occurred with the medial capsulotomy (45% decrease). The lateral release combined with the adductor tenotomy decreased the blood flow to the metatarsal head by 13%, and the metatarsal osteotomy decreased blood flow by an additional 13%. Total decrease in blood flow to the head was 71%. No patients developed avascular necrosis.

Correct Answer: During the medial capsular release

1333. (3817) Q3-7600:

In a randomized controlled trial comparing first metatarsophalangeal arthrodesis versus total joint replacement arthroplasty for end-stage hallux rigidus, all of the following statements are true except:

1) There was a significant improvement in functional outcome in the arthrodesis group compared to the arthroplasty group.
3) Following arthroplasty, patients tend to bear weight on the lateral border of the foot.
2) Following arthroplasty, there was a significant increase in dorsiflexion compared to preoperative status.
5) Fusion had a lower complication rate than arthroplasty.
4) The cost ratio was 2:1 in favor of arthrodesis.

In the study by Gibson and Thomson, 38 fusions and 39 arthroplasties were prospectively compared at 2-year follow-up. There was an 82% improvement in the arthrodesis group and only a 45% improvement in the arthroplasty group. Fusion also had lower complication rates and lower cost. There was not a significant increase in first metatarsophalangeal joint dorsiflexion between preoperative and postoperative levels following total joint replacement.

Correct Answer: Following arthroplasty, there was a significant increase in dorsiflexion compared to preoperative status.

1334. (3818) Q3-7601:

The nonunion rate for the Lapidus procedure (first tarsometatarsal arthrodesis) for the treatment of moderate to severe hallux valgus is:

1) 2%
3) 15%
2) 7%
5) 25%
4) 20%

In a prospective cohort study following 105 Lapidus bunionectomies for 3.7 years, the nonunion rate was found to be 6.7%. The American Orthopaedic Foot & Ankle Society scores improved significantly, and loss of correction over 3.7 years was less than 1Â° for intermetatarsal and hallux valgus angles.

Correct Answer: 7%

1335. (3819) Q3-7602:

When using external fixation in the treatment of tibial pilon fractures, distal transfixation wires:

1) Should always traverse the distal tibia-fibula joint for optimal fixation
3) Are not at risk for causing joint infection
2) Should remain more than 12.2 mm above the subchondral plate of the distal tibia
5) Should remain at least 5 mm above the subchondral plate of the distal tibia
4) Are least at risk for penetrating the joint capsule over the anterolateral aspect of the ankle

In a cadaveric and in vivo study of the reflections of the ankle joint capsule, the distal tibia-fibula joint was found to communicate with the ankle joint capsule, thus representing a risk for ankle sepsis if it is penetrated by a transfixion wire. The anterolateral capsule displayed the most proximal reflection in all specimens.

Correct Answer: Should remain more than 12.2 mm above the subchondral plate of the distal tibia

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1336. (3820) Q3-7603:

The best clinical outcome following a primarily ligamentous Lisfranc injury is with:

1) Protected weight-bearing and early range of motion in a removable boot
3) Open reduction and internal fixation of the Lisfranc injury
2) Non-weight bearing in a fiberglass cast
5) Primary repair of the ligaments
4) Primary arthrodesis of the Lisfranc injury

Forty-one patients were prospectively randomized into traditional open reduction internal fixation (ORIF) versus primary arthrodesis. The American Orthopaedic Foot & Ankle Society scores at 2-year follow-up were significantly better in the fusion group versus the ORIF group. Of the patients in the ORIF group, 25% later developed arthritis and were converted to fusions.

Correct Answer: Primary arthrodesis of the Lisfranc injury

1337. (3821) Q3-7604:

The clinical variable found to be associated with a higher risk of complications following open reduction and internal fixation of unstable ankle fractures in diabetic patients was:

1) Presence of a severe fracture pattern
3) Insulin-dependent diabetes mellitus
2) Presence of an open fracture
5) Presence of nephropathy
4) Peripheral neuropathy or vasculopathy

A retrospective Level IV study followed 84 patients with diabetes who underwent open reduction internal fixation of unstable ankle fractures. After analyzing multiple patient factors including sex, fracture pattern, open or closed injury, nephropathy, hypertension, vasculopathy, peripheral neuropathy, and diabetic control (insulin-dependent compared with non-insulin-dependent), the only factors that predicted a higher rate of complications were vasculopathy and peripheral neuropathy. There was a 12% rate of postoperative infection and an overall 14% rate of complications.

Correct Answer: Peripheral neuropathy or vasculopathy

1338. (3822) Q3-7605:

Which modality for the treatment of chronic insertional Achilles tendinopathy was shown to have the best clinical outcome:

1) Concentric Achilles tendon stretching
3) Short-term immobilization of the ankle in equinus
2) Eccentric Achilles tendon stretching
5) Topical anesthetic
4) Low-energy shockwave therapy

A randomized controlled trial compared recalcitrant insertional Achilles tendinopathy treated with eccentric heel cord stretching versus low-energy shockwave therapy. At 4 months, 28% of the stretching group and 64% of the shockwave therapy group reported complete relief of symptoms or greatly improved symptoms. All outcome measures showed favorable results with shockwave therapy.

Correct Answer: Low-energy shockwave therapy

1339. (3823) Q3-7606:

Urgent closed reduction of ankle fracture-dislocations using intraarticular lidocaine injection:

1) Provides a similar degree of analgesia compared to conscious sedation
3) Results in inferior reduction of ankle deformity compared to conscious sedation
2) Requires more time to perform the reduction and splint the leg than with conscious sedation
5) Is painful due to distension of the joint capsule
4) Requires frequent repeat reduction procedures due to persistent fracture malalignment

A prospective randomized study compared intraarticular lidocaine injection to conscious sedation for analgesia during reduction of ankle fracture-dislocations. There was no difference in the amount of analgesia provided by the two methods. Time for reduction and splinting was less in the local anesthetic group. Quality of reduction was similar in both groups.

Correct Answer: Provides a similar degree of analgesia compared to conscious sedation

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1340. (3865) Q3-7648:

A tailorâs bunion is an abnormal prominence of the lateral aspect of the 5th metatarsal head. Similar to hallux valgus deformities, tailorâs bunions can be due to a widened intermetatarsal angle between the 4th and 5th metatarsal shafts. The normal 4-5 intermetatarsal angle is:

1) Less than 8Â°-9Â°
3) Less than 15Â°
2) Less than 12Â°
5) Less than 25Â°
4) Less than 20Â°

4-5 intermetarsal angle in normal feet averages 6.2 degrees. Different authors believe an abnormally wide 4-5 intermetatarsal angle to be anything greater than 8Â°-9Â°.

Correct Answer: Less than 8Â°-9Â°

1341. (3866) Q3-7649:

A 54-year-old woman with a 10-year history of type II diabetes mellitus develops a Wagner grade 2 ulceration under the first metatarsal head, which has not healed for 3 months. There is no gross cellulitis or drainage. A tagged white blood cell scan shows no signs of osteomyelitis, and noninvasive vascular studies reveal normal hemodynamics. She has failed wet-to-dry normal saline dressings and bacitracin ointment local wound care. The next step in treating this patientâs chronic ulcer is:

1) Application of hydro-colloid gel dressings
3) Application of a total contact cast by a qualified physician or cast technician
2) Use of a custom-made pressure off-loading plastizote insole
5) Amoxicillin/clavulanate potassium 875 mg twice daily
4) Regular debridment of the ulcer

The description of the ulcer indicates that it is not grossly infected and that there is no underlying bony involvement. According to evidence based medicine, the only treatments that are likely to be effective in the healing of diabetic foot ulcerations are topical growth factors, total contact casting, and for severely infected ulcers hyperbaric oxygen.

Correct Answer: Application of a total contact cast by a qualified physician or cast technician

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1342. (3916) Q3-7796:

Which is the best match in surface topography when performing an osteochondral autograft transplantation procedure from the distal femur to the talar dome for an osteochondral lesion of the talus:

1) From the superior-medial femoral condyle to the antero-medial talar dome
3) From the superior-lateral femoral condyle to any position on the medial talar dome
2) From the inferior-medial femoral condyle to the postero-medial talar dome
5) From the inferior-lateral femoral condyle to the antero-medial talar dome
4) From the inferior-medial femoral condyle to the centro-medial talar dome

In a magnetic resonance imaging topography study looking for the best corresponding shape of the articular surface between the non-weightbearing femoral condyle and the medial talar dome, plugs from the supero-lateral femoral condyle had the best fit with osteochondral lesions of the medial talus in the anterior, central, and posterior zones.

Correct Answer: From the superior-lateral femoral condyle to any position on the medial talar dome

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1343. (3918) Q3-7852:

The most frequent location for osteochondral lesions of the talar dome is:

1) Anterolateral talar dome (Raikin zone 3)
3) Lateral talar dome, mid-body (Raikin zone 6)
2) Posteromedial talar dome (Raikin zone 7)
5) Anteromedial talar dome (Raikin zone 1)
4) Medial talar dome, mid-body (Raikin zone 4)

A survey of 428 osteochondral lesions of the talus was undertaken using a nine zone anatomical grid system to determine the most frequent location in which these lesions occur. Results showed that 62% of lesions occurred in the medial talar dome and 34% over the lateral talar dome. The most frequent location along the medial dome was the mid-body of the talus. Medial lesions were larger in surface area as well as deeper than lateral lesions.

Correct Answer: Medial talar dome, mid-body (Raikin zone 4)

1344. (3919) Q3-7853:

Which gait parameters are significantly improved following first metatarsophalangeal arthrodesis for symptomatic hallux rigidus:

1) Maximal ankle push off power
3) Walking velocity
2) Stride length
5) Foot progression angle
4) Cadence

A prospective gait study was performed measuring various gait parameters 1 week prior to and 1 year following first metatarsophalangeal joint arthrodesis. The three significant changes in gait were increased maximal ankle push off power, increased single limb support time on the affected limb, and decreased step width. Stride length, walking velocity, and cadence were not significantly different after fusion.

Correct Answer: Maximal ankle push off power

1345. (3920) Q3-7855:

Which clinical or radiographic finding is not commonly associated with moderate or severe hallux valgus deformity in adults:

1) Positive family history
3) Oval or curved metatarsophalangeal joint on radiographs
2) Presence of bilateral bunion deformity
5) Achilles tendon contracture
4) Longer 1st metatarsal than 2nd metatarsal

A clinical series of 122 bunions was evaluated for demographic, etiologic, and radiographic findings associated with moderate to severe hallux valgus deformity. The following findings were reported:

- 83% of patients had a positive family history of bunions
- 84% of patients had bilateral bunion deformities
- 71% of patients had curved or oval-shaped metatarsophalangeal joints
- 71% of patients had a longer 1st metatarsal compared to the 2nd metatarsal by an average of 2.4 mm
- 11% of bunions were associated with an Achilles tendon contracture

Correct Answer: Achilles tendon contracture

1346. (3921) Q3-7856:

A 58-year-old runner has symptoms of chronic noninsertional Achilles tendinopathy for 8 months. Rest, ice, anti-inflammatory medications, and heel wedges have not helped. Which of the following treatments may help alleviate this patientâs symptoms:

1) Concentric Achilles tendon stretching
3) Intratendinous cortisone injection
2) Topical lidocaine patches
5) Oral fluorquinolone therapy
4) Topical glyceryl trinitrate

Noninsertional Achilles tendinosis is a noninflammatory degenerative condition that is common in middle-aged athletes. In a 3-year follow-up study examining the use of topical glyceryl trinitrate for Achilles tendinosis, patients were noted to have significantly less tendon tenderness and improved clinical scores compared to the placebo group. At 3 years, 88% of treated patients were asymptomatic. Novel nonoperative measures include sclerosing injections into the Achilles tendon with polidocanol and shock-wave therapy to the Achilles tendon.

Correct Answer: Topical glyceryl trinitrate

1347. (3922) Q3-7858:

When comparing complication rates following operative and nonoperative management of ankle fractures in the elderly (age 65-99):

1) Operatively managed patients have a higher mortality rate and a higher rehospitalization rate than conservatively managed patients.
3) Operatively managed patients have a lower mortality rate and a lower rehospitalization rate than conservatively managed patients.
2) Operatively managed patients have a higher mortality rate but a lower rehospitalization rate than conservatively managed patients.
5) Operatively managed patients have a high rate of revision of internal fixation, conversion to arthroplasty or arthrodesis, or amputation.
4) Operatively managed patients have a lower mortality rate but a higher rehospitalization rate than conservatively managed patients.

A study using the National Medicare Claims History System was performed looking at outcomes following ankle fracture in 33,704 elderly patients, specifically looking at mortality, rehospitalization, and the need for additional surgery. Researchers found that conservatively managed patients had a higher mortality rate up to 2 years following injury compared to patients who underwent open reduction internal fixation. Operatively treated patients had a higher rate of rehospitalization following their injury. Less than 1% of patients required revision of internal fixation, arthroplasty, arthrodesis, or amputation.

Correct Answer: Operatively managed patients have a lower mortality rate but a higher rehospitalization rate than conservatively managed patients.

1348. (3923) Q3-7861:

Exposure of tendons to ciprofloxacin in vitro causes all of the following except:

1) A decrease in fibroblast proliferation
3) A decrease in proteoglycan synthesis
2) An increase in proteoglycan synthesis
5) A decrease in collagen synthesis
4) An increase in matrix degrading proteolytic activity

Ciprofloxacin was shown to cause a decrease in fibroblast proliferation, proteoglycan synthesis, and collagen synthesis. Matrix degrading proteolytic activity was increased.

Correct Answer: An increase in proteoglycan synthesis

1349. (3924) Q3-7863:

Following first metatarsophalangeal joint cheilectomy for hallux rigidus, which patient parameter is NOT altered compared to preoperative values:

1) Shifting of plantar forefoot pressures medially toward the hallux
3) Increased first metatarsophalangeal joint dorsiflexion during gait
2) Increased active dorsiflexion of the first metatarsophalangeal joint
5) Increased hallux abduction
4) Decreased first metatarsophalangeal joint plantarflexion at rest

The resting position of the hallux in normal patients is 20Â° of dorsiflexion relative to the first metatarsal shaft. In patients with hallux rigidus, the resting position is decreased to 10Â° of dorsiflexion relative to the metatarsal shaft. This relatively plantarflexed position was not improved to a more normal value following cheilectomy.

Correct Answer: Decreased first metatarsophalangeal joint plantarflexion at rest

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1350. (3925) Q3-7865:

The Brostrom lateral ligament reconstruction is a reliable technique for primary stabilization of ankle instability. The Gould modification of this technique uses which structure to reinforce the repair:

1) One half of the peroneus brevis
3) The calcaneofibular ligament
2) One half of the peroneus longus
5) The posterior inferior tibiofibular ligament
4) The inferior extensor retinaculum

The initial description of the Gould modification of the Brostrom procedure recommended âsuturing what one finds (there is always some ligament present) and reinforcing the anterior talofibular ligament repair with overlap of the nearby lateral talocalcaneal ligament plus the marginal ankle retinaculumâ.

Correct Answer: The inferior extensor retinaculum

1351. (3926) Q3-7868:

Following ankle injury, which radiographic parameter is indicative of syndesmotic instability:

1) Medial clear space greater than 2 mm
3) Syndesmotic overlap of less than 1 mm measured 1 cm above the ankle joint on the mortise view
2) Syndesmotic clear space greater than 5 mm measured 2 cm above the ankle joint on the anteroposterior (AP) view
5) Syndesmotic overlap of less than 1 mm measured 1 cm above the ankle joint on the AP view
4) Syndesmotic clear space greater than 5 mm measured 1 cm above the ankle joint on the mortise view

The normal radiographic findings of the syndesmosis on plain radiographs of the ankle are:

- Medial clear space less than or equal to 4 mm
- Syndesmotic clear space less than 5 mm measured 1 cm above the ankle joint on the AP view of the ankle
- Syndesmotic overlap greater than 1 mm measured 1 cm above the ankle joint on the mortise view of the ankle

Correct Answer: Syndesmotic overlap of less than 1 mm measured 1 cm above the ankle joint on the mortise view

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1352. (3927) Q3-7870:

In children between ages 7 and 11 with bilateral flexible flatfeet and without any pathologic findings, the use of custom-made orthotics or off-the-shelf orthotics demonstrate:

1) Significant improvement in motor proficiency compared to controls treated without orthotics
3) Significant improvement in exercise efficiency compared to controls treated without orthotics
2) Significant improvement in visual analog pain scores compared to controls treated without orthotics
5) No significant difference compared to controls with regards to motor proficiency, pain, exercise efficiency, or self-perception
4) Significant negative effects on the childâs self-perception compared to controls treated without orthotics

In a randomized controlled trial comparing children with flatfeet treated with custom orthotics, off-the-shelf orthotics, and no treatment, there were no differences in the above parameters found. The study concluded that no significant difference was found with regard to motor proficiency, pain, exercise efficiency, or self-perception.

Correct Answer: No significant difference compared to controls with regards to motor proficiency, pain, exercise efficiency, or self-perception

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1353. (3928) Q3-7872:

Following open reduction and internal fixation of ankle fractures, early mobilization in a removable cast demonstrated:

1) Lower functional scores compared to non-weight bearing cast treatment at 9 and 12 weeks
3) Improved quality of life compared to non-weight bearing cast treatment at 6 months
2) Earlier return to work compared to non-weight bearing cast treatment
5) A lower postoperative rate of infection compared to non-weight bearing cast treatment
4) Lower costs in physical therapy following discontinuation of cast or boot

Patients treated with early mobilization in a removable custom fiberglass orthosis (non-weight bearing) had higher early functional scores, earlier return to work, but a higher rate of postoperative wound infection. There were no differences between the two groups with regard to the quality of life at 6 months or the costs of physical therapy.

Correct Answer: Earlier return to work compared to non-weight bearing cast treatment

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1354. (3929) Q3-7874:

In comparing the clinical efficacy of intra-articular sodium hyaluronate injections vs triamcinolone injections for the treatment of hallux rigidus, which factor showed significantly better improvement in the sodium hyaluronate group:

1) Gait pain
3) Pain with passive mobilization
2) Pain at rest
5) Pain with palpation
4) Use of analgesics

In a prospective randomized study comparing sodium hyaluronate vs cortisone injections for hallux rigidus, gait pain and AOFAS scores were significantly better in the sodium hyaluronate-treated group. There was no significant difference between the two treatment groups with regard to rest pain, pain with mobilization, pain with palpation, and use of analgesics.

Correct Answer: Gait pain

1355. (3930) Q3-7875:

Which anatomical feature does not predispose patients to peroneal tendon dislocation:

1) Shallow peroneal groove
3) Peroneus quartus
2) Insufficient superior peroneal retinaculum
5) Varus heel alignment
4) Low-lying peroneus brevis muscle belly

A varus heel alignment would stabilize the peroneal tendons medially into the peroneal groove. Valgus heel alignment is associated with increased risk for peroneal tendon dislocation because this predisposes the tendons to move laterally out of the groove. The other anatomical features have all been implicated as risk factors for peroneal tendon dislocation.

Correct Answer: Varus heel alignment

1356. (3931) Q3-7876:

A 39-year-old man has a forced dorsiflexion injury while skiing. Radiographs taken in the emergency department show a small avulsion flake off the lateral surface of the fibula distally on the mortise view. This patient most likely has:

1) A lateral process of the talus fracture
3) An anterior process of the calcaneus fracture
2) An osteochondral fracture of the talus
5) A syndesmotic sprain
4) A peroneal tendon dislocation

A forced dorsiflexion injury, especially with skiing, is a common mechanism described for peroneal tendon dislocation. All of the diagnoses listed are potential injuries that can initially be mistaken for an ankle sprain. The flake avulsion off of the lateral border of the distal fibula is almost pathognomonic of a peroneal tendon dislocation injury.

Correct Answer: A peroneal tendon dislocation

1357. (3932) Q3-7877:

Which of the following is not considered to be a risk factor for peroneal tendon tears:

1) Shallow retromalleolar groove
3) Ligamentous laxity
2) Gastrocnemius-soleus contracture
5) Recurrent lateral ankle ligament instability
4) Varus hindfoot alignment

A shallow retrofibular groove and ligamentous laxity predispose to subluxation of the peroneal tendons causing attritional tears over the posterolateral fibular ridge. Varus hindfoot alignment places patients at risk for inversion sprains, which may cause trauma to the peroneal tendons when they are put on stretch. Heel chord contracture has not been implicated in the development of peroneal tendon tears.

Correct Answer: Gastrocnemius-soleus contracture

1358. (458) Q4-633:

The thoracic outlet syndrome is characterized by:

1) The invariable presence of abnormal congenital structures such as cervical ribs or costovertebral synestosis
3) A high incidence of vascular symptoms and a low incidence of neurological symptoms
2) Proximal compression of upper extremity neurologic and vascular structures at one of multiple
5) A frequently identifiable traumatic precipitant.
4) Compression of the subclavian vein between the anterior and middle scalene muscles

The thoracic outlet syndrome is a compressive neurovascular disorder of the upper extremity with many possible sites of entrapment. Abnormal congenital structures, macro-, and micro-trauma have all been implicated as possible mechanisms for the process, though none of these factors is an absolute requisite for the disorder. Neurologic symptoms are more common than vascular complaints. The subclavian vein passes *anterior* to the interscalene interval which *contains* the subclavian artery and the brachial plexus.Correct Answer: Proximal compression of upper extremity neurologic and vascular structures at one of multiple

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1359. (459) Q4-635:

A typical presentation of thoracic outlet syndrome is likely to include:

1) An upper plexus constellation involving median nerve innervated muscles being the most common.
3) Venous obstruction presenting as edema and cyanosis progress to subclavian or axillary vein thrombosis.
2) Sensory loss and diminished strength at initial evaluation
5) Normal somatosensory evoked potentials in the affected extremity
4) Symptoms that are present at rest and alleviated by upper extremity acitivity

A lower plexus symptom constellation involving muscles supplied by the ulnar nerve is most typical of thoracic outlet syndrome. Objective signs of sensory loss and diminished strength are often not found. Somatosensory evoked potential abnormalities are common (74%), but are non-specific and may be seen in asymptomatic individuals. Although venous obstruction is rare, it may lead to subclavian or axillary vein thrombosis necessitating fibrinolytic treatment. Symptoms are usually exacerbated by upper extremity activities.Correct Answer: Venous obstruction presenting as edema and cyanosis progress to subclavian or axillary vein thrombosis.

1360. (460) Q4-636:

Primary treatment of thoracic outlet syndrome should include:

1) First rib resection with scalenectomy
3) Psychiatric evaluation
2) Claviculectomy
5) First rib resection without scalenectomy
4) Activity modification and shoulder girdle strengthening

Initial treatment of thoracic outlet syndrome is non-operative. Aggravating activities are modified and shoulder girdle strengthening is initiated. Surgery is considered for patients who have failed conservative therapy and suffer intractable pain, and for those who have significant neurologic or vascular deficits. Operative procedures must be tailored to the presumed pathological anatomy; there is no single best procedure.Correct Answer: Activity modification and shoulder girdle strengthening

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1361. (461) Q4-637:

The term acrosyndactyly describes digits that are:

1) Joined by bone only
3) Joined proximally but separated distally
2) Joined by soft tissue only
5) Joined at the tips but separated proximally
4) Joined along the entire length of the web space

Acrosyndactyly describes digits that are joined distally but remain separated by a proximal cleft. Acrosyndactylized digits initially develop normal web spaces, but are subsequently joined by secondary events, such as the formation of constriction bands. In contrast to syndactylized fingers, which remain joined due to failure of formation of the web space between contiguous digits, acrosyndactyly may form between non-contiguous digits. Complex syndactyly involves a confluence of distal osseous and nail elements in addition to soft-tissue bridging. Simple syndactyly describes digits that are joined by soft tissue only. Finally, complete syndactyly refers to digits that are joined along their entire lengths, while incomplete syndactyly describes a web that extends more distally than usual, but not all the way to the finger tips.Correct Answer: Joined at the tips but separated proximally

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1362. (462) Q4-638:

In normal development, the differentiation of the interdigital web space is influenced by which of the following factors:

1) Bone morphogenetic protein (BMP)
3) Interleukin-1 (IL-1)
2) Fibroblast growth factor-3 (FGF-3)
5) Thalidomide
4) Apical ectodermal ridge maintenance factor (AERMF)

The distal phalanges are composed of two germ cell layers. Ectodermal cells produce the tuft of the distal phalanx and the nail elements, while mesodermal cells form the epiphysis, physis, and metaphysis. Apical ectodermal ridge maintenance factor (AERMF) is a substance elaborated by the mesenchymal condensations between digits. When AERMF ceases to be produced, the apical ectodermal ridge begins to break apart. This in turn triggers the release of lysosomes which dissolve the mesenchymal connections between the developing digits, completing web space formation.Correct Answer: Apical ectodermal ridge maintenance factor (AERMF)

1363. (463) Q4-639:

Syndactyly may be isolated, it may be bilateral, or it may occur as part of a broader genetic syndrome. Which of the following syndromes are commonly associated with syndactyly:

1) Down syndrome (trisomy-21)
3) Marfan syndrome
2) Polandâs anomaly
5) Hunter syndrome
4) VATER association

Individuals afflected by Polandâs anomaly exhibit unilateral symbrachydactyly (simple syndactyly with short or absent middle phalanges), absent sternocostal head of the pectoralis major, and hypoplasia of the ipsilateral breast and nipple. Apertâs syndrome, the other syndrome most commonly associated with syndactyly, is characterized by complex acrosyndactyly of the hands and feet associated with premature closure of the cranial sutures. The features of the VATER association include Verterbral anomalies and or Ventricular septal defect, Anal atresia, T-E fistula, and Renal anomalies and or Radial dysplasia (pre-axial syndactyly is a possible but inconsistent feature). Individuals with Marfan syndrome exhibit arachnodactyly in addition to retinal detachments, lens subluxations, aortic dilatations/aneurysms, and tall stature with long, thin limbs. Hand manifestations of Down syndrome include short metacarpals and phalanges, clinodactyly, and abnormal crease patterns, but not syndactyly. Hunter syndrome (mucopolysaccharidosis II) is marked by stiffened joints and the development of a clawhand, but not by syndactyly.Correct Answer: Polandâs anomaly

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1364. (464) Q4-640:

Surgical separation of syndactylized fingers produces two separate digits with an increase in total surface area. How are the gaps in coverage left by eliminating the common side between the two fingers best addressed:

1) Full-thickness skin graft
3) Fascio-cutaneous graft
2) Split-thickness skin graft
5) No graft is necessary; the defects will heal by secondary intention
4) Rotation flap

If syndactyly release is to be successful, contractures must be avoided at all costs. Tension-free closures are imperative to this effort. The surface area of two complete fingers is substantially greater than that of two fingers that share a common side, so primary closure of the skin on both sides of the new web is not possible without tension except in very proximal, incomplete syndactylies. For this reason, a strategy other than primary closure is necessary. Healing by secondary intention and split-thickness grafting are both prone to produce contracture. Fascio-cutaneous grafting and rotation flaps are unnecessary, since the defect is confined to the dermal layer. Full-thickness skin graft is least likely to contract, and thus is the material of choice for closing the separated digits.Correct Answer: Full-thickness skin graft

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1365. (473) Q4-651:

The _____ of the brachial plexus emerge between the anterior middle scalane muscles:

1) Roots
3) Divisions
2) Trunks
5) Branches
4) Cords

After the roots emerge between the anterior scalene muscles, they merge to form trunks. The trunks branch into divisions and then merge into cords in the axilla. The cords branch into nerves.Correct Answer: Roots

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1366. (474) Q4-653:

Dupuytren contracture is a progressive disease involving:

1) Proliferative fibrodysplasia of the flexor tendons in the palm.
3) A chronic inflammatory response with an increase in type 2 collagen in the flexor tendon sheath.
2) Pretendinous bands of the palmar aponeurosis which form nodules and cords causing metacarpophalangeal joint contracture.
5) A predilection for young women between the ages of 20 and 40 with exacerbation of symptoms during pregnancy.
4) Contracture beginning distally at the level of the distal interphalangeal joint and extending proximally as the disease progresses.

Dupuytren contracture involves proliferative fibrodysplasia of the subcutaneous palmar connective tissue. The flexor tendons are not involved. Pretendinous bands of the palmer aponeurosis form nodules and cords causing metacarpophalangeal joint contracture. The interphalangeal joint can be affected but only rarely is the distal interphalangeal joint involved. There is no inflammatory response but a proliferation of myofibroblasts with an increase in Type 3 collagen. The disease is most often seen in men between the ages of 40 and 60 years old and is associated with epilespy, alcoholism and diabetes. Carpal tunnel syndrome is often seen in young women and can be exacerbated by pregnancy.Correct Answer: Pretendinous bands of the palmar aponeurosis which form nodules and cords causing metacarpophalangeal joint contracture.

1367. (475) Q4-654:

Which of the following statements is true:

1) Spinnerâs sign is an early sign of anterior interosseous nerve compression.
3) The ligament of Strutherâs and the arcade of Strutherâs refer to the same structure.
2) Electromyography/nerve conduction velocity is usually normal in pronator syndrome.
5) The pain of pronator syndrome is dull aching in the proximal forearm that is worse with activity and awakens patients at night.
4) Forearm pronation is usually weak with anterior interosseous nerve syndrome.

Electromyography/nerve conduction velocity is usually normal in pronator syndrome, but abnormal in anterior interosseous nerve syndrome. The arcade of Struthers describes a possible point of compression of the ulnar nerve. The ligament of Struthers describes a possible point of compression of the median nerve. In AIN syndrome, forearm pronation may be weak due to weakness of the pronator quadratus, but the pronator teres is unaffected. There is no strict correlation between the pain of pronator syndrome and sleeplessness.Correct Answer: Spinnerâs sign is an early sign of anterior interosseous nerve compression.

1368. (476) Q4-655:

Initial treatment for De Quervain disease involves:

1) Occupational therapy with active range of motion and strengthening of the wrist extensors.
3) Steroid injection of the second dorsal compartment followed by range of motion exercises.
2) Surgical release of the extensor pollicis longus tendon as it wraps around Listerâs tubercle.
5) Surgical release of the first dorsal compartment.
4) Activity modification, steroid injection of the first dorsal compartment, followed by splinting full time for 3 to 4 weeks.

Initial treatment for De Quervain tenosynovitis involves rest and splinting with steroid injection into the first dorsal compartment. The splint should be worn as much as possible for 3 to 4 weeks. The extensor carpi radialis brevis has been implicated in lateral epicondulitis. The extensor pollicis longus can be a source of pain as it wraps over the wrist extensor giving the classic symptoms of intersection syndrome between the second and third dorsal compartments. Surgical release is only indicated in persistent cases that have failed conservative management. In 20% to 30% of cases, the first compartment is divided by longitudinal septations into two distinct tunnels. Care must be taken to identify and release both of these tunnels, as well as any multiple tendinous slips, when performing a surgical release.Correct Answer: Activity modification, steroid injection of the first dorsal compartment, followed by splinting full time for 3 to 4 weeks.

1369. (477) Q4-656:

The ulnar nerve arises from:

1) The lateral cord of the brachial plexus containing fibers from the C6 and C7 nerve roots.
3) The posterior cord of the brachial plexus containing fibers of the C5 and C6 nerve roots.
2) The medial cord of the brachial plexus containing fibers from the C8 and T1 nerve roots.
5) The C5 through C7 nerve roots immediately before the upper trunk.
4) The lateral trunk of the brachial plexus containing fibers from C7 through T1.

The ulnar nerve is the continuation of the medial cord of the brachial plexus containing fibers of the C8 and T1 nerve roots. Radiculopathy at the C8-T1 level may mimic a more distal compression of the nerve in the cubital tunnel. The axillary and radial nerves come off the posterior cord. There is no lateral trunk of the brachial plexus. The nerve to the rhomboids comes directly off of the C5 nerve root and its presence is often helpful in differentiating pre-ganglionic from post-ganglionic lesions of the brachial plexus.

The lateral cord forms the musculocutaneous nerve. The medial cord forms the ulnar nerve. The medial and lateral cords form the median nerve. The radial nerve arises from the posterior cord.Correct Answer: The medial cord of the brachial plexus containing fibers from the C8 and T1 nerve roots.

1370. (478) Q4-658:

Which of the following statements is true:

1) Posterior interosseous nerve syndrome and radial tunnel syndrome describe the same clinical syndrome with separate causes.
3) The posterior interosseous nerve contains both motor and sensory fibers.
2) The radial nerve spirals around the humeral shaft with the radial artery.
5) The most common site of proximal radial nerve compression is the leash of Henry.
4) Wartenberg's sign and Wartenberg's syndrome are both related to radial nerve compression.

The PIN contains motor fibers to the EDC, EDQP, ECU, APL, EPB, EPL, and EIP. Occasionally it gives motor fibers to the ECRB. It terminates with a sensory branch to the carpus and wrist capsule. There is, however, no cutaneous sensation.

In radial tunnel syndrome, the entire radial nerve is compressed, including a sensory component. The radial nerve passes posteriorly and laterally next to the humerus, but not with the radial artery. Wartenberg's sign is an isolated ulnar nerve palsy. This syndrome relates to the compression of the superficial branch of the radial nerve. The most common site of radial nerve compression is the arcade of Frohse.Correct Answer: The posterior interosseous nerve contains both motor and sensory fibers.

1371. (479) Q4-659:

The treatment of stenosing tenosynovitis should include all of the following except:

1) Release of the A1 pulley.
3) Splinting and nonsteroidal anti-inflammatory drugs (NSAIDs).
2) Release of the A1 pulley and flexor tendon tenosynovectomy.
5) Release of the A1 and A2 pulleys.
4) Steroid injections between the flexor tendon and the A1 pulley.

The A2 pulley should not be released as part of the treatment for trigger finger. Its presence, along with the A4 pulley, is important in maintaining efficient flexor tendon function. The pathology usually involves the A1 pulley and its release is usually all that is necessary.

Other modalities include NSAIDs, splinting, tenosynovectomy, and steroid injections.

Correct Answer: Release of the A1 and A2 pulleys.

1372. (480) Q4-660:

Swan-neck deformity can be caused by which of the following:

1) Central slip rupture
3) Acute extensor tendon avulsion fracture
2) Flexor digitorum profundus avulsion fracture (Jersey finger)
5) Metaphalangeal (MP) arthroplasty
4) Dorsal proximal interphalangeal joint dislocation (middle phalanx dorsal to proximal phalanx)

A chronic mallet finger results in proximal retraction of the extensor mechanism and overpull of the central slip. Isolated central slip rupture does not cause this deformity. Rupture of the flexor digitorum sublimis can cause Swan-neck deformity. MP arthroplasty is not associated with this deformity. The sequalae of dorsal proximal interphalangeal joint dislocation (e.g., volar plate laxity or deficiency) leads to Swan-neck deformity.Correct Answer: Dorsal proximal interphalangeal joint dislocation (middle phalanx dorsal to proximal phalanx)

1373. (481) Q4-664:

Which of the following identifies the clinical finding of inadvertent hyperextension of the thumb metaphalangeal joint during attempted thumb-index finger pinch?

1) Froment's sign
3) Duchenne's sign
2) Jeanne's sign
5) Wartenberg's sign
4) Pollock's sign

Jeanne's sign identifies thumb metaphalangeal joint hyperextension of 10Â° to 15Â° with key pinch or gross grip.

Froment's sign refers to the exaggeration of thumb interphalangeal joint flexion during key punch by the flexor pollicis longus in ulnar nerve palsies.

Wartenberg's sign is the inability to adduct the extended small finger due to an ulnar nerve palsy.

Duchenne's sign refers to clawing of the ring and small fingers.

Pollock's sign is the inability to flex the distal interphalangeal joints of the ring and small fingers in high palsies.Correct Answer: Jeanne's sign

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1374. (482) Q4-665:

The Bunnell procedure to provide index finger abduction in ulnar nerve palsies refers to:

1) Transfer extensor indicis proprius (EIP) to the first dorsal interosseous
3) Transfer extensor pollicis brevis (EPB) to the first dorsal interosseous
2) Split and transfer EIP to the first dorsal interosseous and the adductor pollicis
5) Transfer flexor digitorum sublimis to the proximal phalanx of the thumb
4) Transfer EPB with EIP to the adductor pollicis

The Bunnell procedure transfers the EIP to the first dorsal interosseous. Answers B through E refer to the Omer technique, Bruner technique, Abreu technique, and Graham procedure or Riordan procedure, respectively.Correct Answer: Transfer extensor indicis proprius (EIP) to the first dorsal interosseous

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1375. (565) Q4-784:

Ganglions most commonly arise from the:

1) Scapholunate interosseous ligament
3) Pisotriquetral joint
2) Scaphotrapezial joint
5) Flexor tendon sheath
4) Dorsal distal interphalangeal joint

Sixty percent to 70% of all ganglion cysts occur on the dorsum of the wrist. A majority of ganglions emanate from the scapholunate interosseous ligament. Volar wrist ganglions are prevalent in 16% to 20% of cases, followed by volar retinacular ganglions occurring at the metacarpophalangeal joints and proximal interphalangeal joints (7% to 12%), and mucous cysts presenting dorsally at the level of the joint.Correct Answer: Scapholunate interosseous ligament

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1376. (566) Q4-785:

Pain from a dorsal carpal ganglion is caused by:

1) Tendinitis
3) Median nerve impingement
2) Posterior interosseous nerve impingement
5) Mass effect
4) Premalignant synovial degeneration

Dorsal carpal ganglions arising from the scapholunate interosseous ligament may expand to a large size without causing significant pain. Alternatively, small ganglions that compress the sensory terminus of the posterior interosseous nerve may be painful. The median nerve, on the volar side of the wrist, is not affected by dorsal ganglions. Dorsal carpal ganglions are benign. They have no potential for malignant degeneration and are not a significant cause of tendinitis.Correct Answer: Posterior interosseous nerve impingement

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1377. (567) Q4-786:

Optimal treatment for a symptomatic ganglion is:

1) Observation
3) Aspiration
2) Closed rupture
5) Corticosteroid injection
4) Surgical excision

Surgical excision of a symptomatic ganglion, with removal of the entire ganglion stalk and a portion of the joint capsule at its base, reliably relieves pain and has a low recurrence rate (approximately 5%). Closed rupture, while potentially effective, has a recurrence rate of approximately 50%. Ganglions are prone to recur after aspiration, although 3 serial aspirations of a ganglion have been shown to reduce the recurrence rate to about 15%. The addition of corticosteroids to aspiration treatment has not been shown to provide any additional benefit. While observation of painless ganglions is certainly acceptable treatment given their benign prognosis, it is not considered the optimal course for a symptomatic lesion.Correct Answer: Surgical excision

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1378. (568) Q4-787:

The following pair of tendons is affected in De Quervain disease:

1) Extensor pollicis longus and extensor pollicis brevis
3) Abductor pollicis brevis and extensor pollicis longus
2) Abductor pollicis longus and extensor pollicis longus
5) Abductor pollicis longus and extensor pollicis brevis
4) Opponens pollicis and abductor pollicis brevis

De Quervain disease affects the tendons in the first dorsal compartment, the extensor pollicis brevis and the abductor pollicis longus (consisting of 2 to 7 individual tendon slips). The extensor pollicis longus traverses the third dorsal compartment. The abductor pollicis brevis and the opponens pollicis are thenar muscles and do not lie within any of the dorsal compartments.Correct Answer: Abductor pollicis longus and extensor pollicis brevis

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1379. (569) Q4-789:

Poor or incomplete resolution of symptoms following first dorsal compartment release for De Quervain disease would most likely occur as a result of:

1) Early return to activity
3) Abductor pollicis longus laceration
2) Superficial radial sensory nerve injury
5) Pseudoaneurysm in the radial artery
4) Incomplete release

The most common reason for recurrent or persistent symptoms of first dorsal compartment stenosis is failure to recognize and release a separate extensor pollicis brevis subsheath. The superficial radial sensory nerve may be injured in surgery for De Quervain disease, but the resulting neuroma is often more painful than the original symptoms and is of a different character. Abductor pollicis longus laceration would result in loss of radial abduction of the thumb. Early motion of the thumb is recommended following release of the first dorsal compartment.Correct Answer: Incomplete release

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1380. (660) Q4-912:

When performing a tendon transfer to restore thumb index finger lateral pinch in an ulnar nerve palsy, which tendon, when transferred to the 1st dorsal interosseous provides the greatest power?

1) Flexor digitorum profundus (FDP)
3) Extensor digitorum communis (EDC)
2) Extensor indicis proprius (EIP)
5) Extensor carpi radialis lingus (ECRL)
4) Extensor carpi radialis brevis (ECRB)

The ECRB transfer gives the greatest return of power pinch due to the strength of this wrist motor. This transfer should be coupled with a thumb MP arthrodesis to provide the best results. The ideal pinch transfer is an extensor pollicis brevis to first dorsal interosseous with a metaphalangeal (MP) arthrodesis at the thumb. The FDP and EDC tendons are not good choices because they are not independent tendons. The EIP provides power, but the vector of the transfer is not ideal. Transfer of the ECRL would unbalance the wrist.Correct Answer: Extensor carpi radialis brevis (ECRB)

1381. (661) Q4-913:

In the diagnosis of a boutonniere deformity, a patient will not present with:

1) Laxity in the intrinsic system leading to passive hyperflexion of the distal interphalangeal joint, with the proximal interphalangeal joint held in extension.
3) Full extension at the proximal interphalangeal joint, with the wrist and metacarpophalangeal joint fully flexed but inability to extend the distal interphalangeal joint with the hand in this position.
2) Ecchymosis at the base of the middle phalanx, with a dorsal avulsion fragment from the middle phalanx base on the x-ray.
5) Pain and swelling over the metacarpophalangeal joint, with full flexion and extension over the proximal interphalangeal joint and distal interphalangeal joint.
4) Active hyperextension at the proximal interphalangeal joint, with full flexion at the distal interphalangeal joint, but no active flexion at the proximal interphalangeal joint.

A boutonniere deformity refers to a finger in which the PIP joint is in a flexed position and the DIP joint is in a hyperextended position. These deformities may be acute or chronic. With the exception of answer choice D, all of the other answers describe possible presentations of a patient with boutonniere deformity. A patient with active hyperextension at the PIP joint with full flexion at the DIP joint, but no active flexion at the PIP joint has a swan-neck deformity.Correct Answer: Active hyperextension at the proximal interphalangeal joint, with full flexion at the distal interphalangeal joint, but no active flexion at the proximal interphalangeal joint.

1382. (671) Q4-924:

In the diagnosis of a boutonniere deformity, a patient may present with:

1) Laxity in the intrinsic system leading to passive hyperflexion of the distal interphalangeal joint, with the proximal interphalangeal joint held in extension.
3) Full extension at the proximal interphalangeal joint, with the wrist and metacarpophalangeal joint fully flexed but inability to extend the distal interphalangeal joint with the hand in this position.
2) Flexion deformity of the PIP joint with ecchymosis at the base of the middle phalanx, with a dorsal avulsion fragment at the middle phalanx base on radiograph, as well as inability to actively extend the PIP joint.
5) Pain and swelling over the metacarpophalangeal joint, with full flexion and extension over the proximal interphalangeal joint and distal interphalangeal joint.
4) Active hyperextension at the proximal interphalangeal joint, with full flexion at the distal interphalangeal joint, but no active flexion at the proximal interphalangeal joint.

A bony boutonniere injury is a fracture of the base of middle phalanx with the central slip of the extensor mechanism attached. With this injury, the patient is unable to actively extend the PIP joint from its flexed position.Correct Answer: Flexion deformity of the PIP joint with ecchymosis at the base of the middle phalanx, with a dorsal avulsion fragment at the middle phalanx base on radiograph, as well as inability to actively extend the PIP joint.

1383. (1157) Q4-1521:

Horner syndrome includes all of the following except:

1) Miosis
3) Enophthalmos
2) Anhidrosis
4) Exophthalmos

Horner syndrome is due to disruption of sympathetic innervation and is characterized by enophthalmos not exophthalmos.

Correct Answer: Exophthalmos

1384. (1158) Q4-1522:

Axonotmesis involves injury to which of the following structure:

1) Epineurium
3) Perineurium
2) Endoneurium
4) Axon

Axonotmesis as described in Seddon classification implies injury to the axon and myelin sheath. It is neurotmesis that involves injury to all the three layers.

Correct Answer: Axon

1385. (1159) Q4-1523:

All of the following may be seen with preganglionic lesion EXCEPT:

1) Horner syndrome
3) Positive Histamine test
2) Hemi-diaphragmatic palsy
4) Tinel sign

Tinel sign is seen with postganglionic lesions.

Correct Answer: Tinel sign

1386. (1160) Q4-1524:

Weakness of which of the following muscles is not seen with root avulsion:

1) Rhomboids
3) Supraspinatus
2) Serratus anterior
4) Trapezius

Trapezius is innervated by spinal accessory nerve and thus will not be involved in a brachial plexus lesion. In the case of a preganglionic lesion, ALL muscles innervated by the nerve roots will be affected.

Correct Answer: Trapezius

1387. (1161) Q4-1525:

In obstetric brachial plexus injury, return of which of the following muscle by 3 months is considered an indicator of plexus recovery:

1) Biceps
3) Brachioradialis
2) Triceps
4) Latissimus

Biceps recovery at 3 months is considered the single most important indicator of recovery in obstetric plexus palsy.

Correct Answer: Biceps

1388. (1162) Q4-1526:

A 15-year-old white boy presents to your office with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and says his neck was twisted away at the time of fall. He was seen at the local emergency department; skull, chest, cervical and thoracic spine, and shoulder x-rays showed no damage. There was no loss of consciousness and he has no chest pain or breathing difficulties. He was observed in the hospital until stable and was referred to follow up in the hand clinic at 4 weeks and scheduled for an electromyogram.

Clinical examination reveals weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature is preserved and he can grasp and release and pinch. Sensations are decreased along the distribution of axillary nerve. There is 3 cm wasting of his arm and 2 cm of his forearm. Tinel sign is positive around the clavicle. Horner signs are absent and his arm lies against the body. The EMG report shows fibrillation potentials in the weak muscles. The parents are concerned and say they have not seen any improvement. The boy reports that he is now able to flex his elbow. When asked to demonstrate you notice that he flexes his wrist and pronates his forearm to âswingâ his elbow into flexion.

The diagnosis of the boyâs condition is:

1) Brachial plexus neuropraxia
3) Brachial plexus neuritis
2) Erbâs palsy
4) C5, C6 disk herniations

The muscles involved have C5, C6 root innervations. There are multiple findings that rule out a preganglionic lesion: positive Tinel sign, functioning rhomboids and serratus anterior, absent Horner syndrome. The electromyogram finding confirms the clinical finding (it does not show subclinical involvement of any other muscle). Neuropraxia usually resolves in 6 weeks and EMG shows fibrillation, both of which are inconsistent with neuropraxia. Brachial plexus neuritis (Parsonage-Turner syndrome) has an acute presentation following a painful episode involving the whole arm. There is significant history of fall from an all terrain vehicle in this case.

Correct Answer: Erbâs palsy

1389. (1163) Q4-1527:

A 15-year-old white boy presents to your office with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and says his neck was twisted away at the time of fall. He was seen at the local emergency department; skull, chest, cervical and thoracic spine, and shoulder x-rays showed no damage. There was no loss of consciousness and he has no chest pain or breathing difficulties. He was observed in the hospital until stable and was referred to follow up in the hand clinic at 4 weeks and scheduled for an electromyogram.

Clinical examination reveals weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature is preserved and he can grasp and release and pinch. Sensations are decreased along the distribution of axillary nerve. There is 3 cm wasting of his arm and 2 cm of his forearm. Tinel sign is positive around the clavicle. Horner signs are absent and his arm lies against the body. The EMG report shows fibrillation potentials in the weak muscles. The parents are concerned and say they have not seen any improvement. The boy reports that he is now able to flex his elbow. When asked to demonstrate you notice that he flexes his wrist and pronates his forearm to âswingâ his elbow into flexion.

What is the level of lesion:

1) Postganglionic C5, C6
3) Posterior cord injury
2) Preganglionic C5, C6
4) Middle trunk

The muscles involved have C5, C6 root innervations. There are multiple findings that rule out a preganglionic lesion: positive Tinel sign, functioning rhomboids and serratus anterior, absent Horner syndrome. The electromyogram finding confirms the clinical finding (it does not show subclinical involvement of any other muscle). Neuropraxia usually resolves in 6 weeks and EMG shows fibrillation, which is inconsistent with neuropraxia. Brachial plexus neuritis (Parsonage-Turner syndrome) has an acute presentation following a painful episode involving the whole arm. There is significant history of fall from an all terrain vehicle in this case.

Correct Answer: Postganglionic C5, C6

1390. (1164) Q4-1528:

A 15-year-old white boy presents to your office with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and says his neck was twisted away at the time of fall. He was seen at the local emergency department; skull, chest, cervical and thoracic spine, and shoulder x-rays showed no damage. There was no loss of consciousness and he has no chest pain or breathing difficulties. He was observed in the hospital until stable and was referred to follow up in the hand clinic at 4 weeks and scheduled for an electromyogram.

Clinical examination reveals weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature is preserved and he can grasp and release and pinch. Sensations are decreased along the distribution of axillary nerve. There is 3 cm wasting of his arm and 2 cm of his forearm. Tinel sign is positive around the clavicle. Horner signs are absent and his arm lies against the body. The EMG report shows fibrillation potentials in the weak muscles. The parents are concerned and say they have not seen any improvement. The boy reports that he is now able to flex his elbow. When asked to demonstrate you notice that he flexes his wrist and pronates his forearm to âswingâ his elbow into flexion.

What is the least helpful test in further management of this patient:

1) Magnetic resonance imaging
3) Repeat electromyogram after 4 weeks
2) Computer tomography scan of the neck
4) Somatosensory evoked potential (SSEP)

Computer tomography scan of the cervical spine will not be of any use as it will neither show the pseudomeningoceles nor provide any information on brachial plexus. CT scan may be needed in case of a suspected neck injury but does not form part of a brachial plexus work up.

Correct Answer: Computer tomography scan of the neck

1391. (1165) Q4-1529:

A 15-year-old white boy presents to your office with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and says his neck was twisted away at the time of fall. He was seen at the local emergency department; skull, chest, cervical and thoracic spine, and shoulder x-rays showed no damage. There was no loss of consciousness and he has no chest pain or breathing difficulties. He was observed in the hospital until stable and was referred to follow up in the hand clinic at 4 weeks and scheduled for an electromyogram.

Clinical examination reveals weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature is preserved and he can grasp and release and pinch. Sensations are decreased along the distribution of axillary nerve. There is 3 cm wasting of his arm and 2 cm of his forearm. Tinel sign is positive around the clavicle. Horner signs are absent and his arm lies against the body. The EMG report shows fibrillation potentials in the weak muscles. The parents are concerned and say they have not seen any improvement. The boy reports that he is now able to flex his elbow. When asked to demonstrate you notice that he flexes his wrist and pronates his forearm to âswingâ his elbow into flexion.

The plan of management in this boy 5 months after injury with no clinical improvement should be:

1) Neurotization
3) Continued observation
2) Exploration and nerve grafting
4) Tendon transfers

Neurotization is appropriate in preganglionic lesions. Around 6 months with no evidence of recovery is ideal time for plexus exploration. Further observation will not change the picture and tendon transfers are reconstructive procedures, which are done at a later stage.

Correct Answer: Exploration and nerve grafting

1392. (1166) Q4-1530:

A 15-year-old white boy presents to your office with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and says his neck was twisted away at the time of fall. He was seen at the local emergency department; skull, chest, cervical and thoracic spine, and shoulder x-rays showed no damage. There was no loss of consciousness and he has no chest pain or breathing difficulties. He was observed in the hospital until stable and was referred to follow up in the hand clinic at 4 weeks and scheduled for an electromyogram.

Clinical examination reveals weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature is preserved and he can grasp and release and pinch. Sensations are decreased along the distribution of axillary nerve. There is 3 cm wasting of his arm and 2 cm of his forearm. Tinel sign is positive around the clavicle. Horner signs are absent and his arm lies against the body. The EMG report shows fibrillation potentials in the weak muscles. The parents are concerned and say they have not seen any improvement. The boy reports that he is now able to flex his elbow. When asked to demonstrate you notice that he flexes his wrist and pronates his forearm to âswingâ his elbow into flexion.

What will be the most important indication for an early exploration in this case:

1) Absence of biceps function at 3 months
3) Presence of âtrickâ movements
2) Absence of biceps function with return of extensor carpi radialis longus (ECRL) power at 4 months
4) Subluxation of humeral head on x-ray

An important indication for early exploration is recovery of a distally supplied muscle (ECRL â C6) in the absence of a proximally supplied muscle (biceps â C5). Trick movements are adaptive movements employed by the patient by recruiting other muscles (use of flexor-pronator as elbow flexors in this patient). Bony deformity is a late sequela and biceps recovery at 3 months is important in obstetric brachial palsy.

Correct Answer: Absence of biceps function with return of extensor carpi radialis longus (ECRL) power at 4 months

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1393. (1167) Q4-1531:

A 15-year-old white boy presents to your office with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and says his neck was twisted away at the time of fall. He was seen at the local emergency department; skull, chest, cervical and thoracic spine, and shoulder x-rays showed no damage. There was no loss of consciousness and he has no chest pain or breathing difficulties. He was observed in the hospital until stable and was referred to follow up in the hand clinic at 4 weeks and scheduled for an electromyogram.

Clinical examination reveals weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature is preserved and he can grasp and release and pinch. Sensations are decreased along the distribution of axillary nerve. There is 3 cm wasting of his arm and 2 cm of his forearm. Tinel sign is positive around the clavicle. Horner signs are absent and his arm lies against the body. The EMG report shows fibrillation potentials in the weak muscles. The parents are concerned and say they have not seen any improvement. The boy reports that he is now able to flex his elbow. When asked to demonstrate you notice that he flexes his wrist and pronates his forearm to âswingâ his elbow into flexion.

The most important function that needs to be restored in this boy is:

1) Shoulder abduction
3) Elbow flexion
2) Shoulder elevation
4) Wrist extension

Elbow flexion is central to management of brachial plexus management because it serves the most important function of feeding.

Correct Answer: Elbow flexion

1394. (1168) Q4-1532:

An 18-month-old boy is brought to your office for a clawing deformity of his right hand. The parents inform you that he was born full term after a difficult delivery complicated by shoulder dystocia. The boy weighed 9Â½ lbs at birth. The child had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the natal intensive care unit. Parents recall having noted a bump on his right clavicle, which was tender and was diagnosed as clavicle fracture. They also noticed a week later that the child did not flex the fingers of his right hand. The neonatologist had informed them that the fracture is managed conservatively and the absence of finger flexion is due to the fracture and shall recover. They were warned that the recovery can be prolonged and can take up to 2 years. The boy has grown well and has achieved his milestones on time. His immunization is complete for his age.

You find a healthy, playful boy who tends to use his left hand to reach for objects. His right hand has extension at all the metacarpophalangeal (MCP) joints of the fingers while his proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are flexed. His thumb is an adducted position and it is difficult to passively bring it to full abduction. There is obvious wasting of the hand and forearm. The child is able to move the arm well with no abnormalities noticed at the shoulder, elbow, and the wrist. The x-ray of his chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Horner Syndrome and the grasp reflex is absent.

The diagnosis of this boyâs condition is:

1) Erbâs palsy
3) Cerebrovascular accident
2) Klumpkeâs palsy
4) Ulnar and median combined nerve injury

This is a case of obstetric brachial plexus injury involving the C8, T1 roots (Klumpke Palsy). Erbâs palsy involves upper roots only. Combined nerve injuries can present in a similar fashion; however, low ulnar and median nerve lesions will not have weakness of flexor digitorum profundus (FDP) and flexor digitorum superficialis (FDS).

History of large baby, shoulder dystocia and clavicle fracture point to a difficult labor. The most common type of brachial plexus injury related to birth is Erbâs palsy, which is usually associated with a breech presentation. Isolated Klumpkeâs palsy is rare, and involvement of C8, T1 usually occurs as part of global plexus injury.

Correct Answer: Klumpkeâs palsy

1395. (1169) Q4-1533:

An 18-month-old boy is brought to your office for a clawing deformity of his right hand. The parents inform you that he was born full term after a difficult delivery complicated by shoulder dystocia. The boy weighed 9Â½ lbs at birth. The child had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the natal intensive care unit. Parents recall having noted a bump on his right clavicle, which was tender and was diagnosed as clavicle fracture. They also noticed a week later that the child did not flex the fingers of his right hand. The neonatologist had informed them that the fracture is managed conservatively and the absence of finger flexion is due to the fracture and shall recover. They were warned that the recovery can be prolonged and can take up to 2 years. The boy has grown well and has achieved his milestones on time. His immunization is complete for his age.

You find a healthy, playful boy who tends to use his left hand to reach for objects. His right hand has extension at all the metacarpophalangeal (MCP) joints of the fingers while his proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are flexed. His thumb is an adducted position and it is difficult to passively bring it to full abduction. There is obvious wasting of the hand and forearm. The child is able to move the arm well with no abnormalities noticed at the shoulder, elbow, and the wrist. The x-ray of his chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Horner Syndrome and the grasp reflex is absent.

The level of the lesion in this boyâs case is:

1) preganglionic lesion
3) lateral cord
2) postganglionic lesion
4) posterior cord

It is difficult to clinically differentiate between a pre- and post ganglionic lesion of C8, T1 in a child. Absence of Hornerâs syndrome and hemi-diaphragmatic palsy in this case indicates that this is not a preganglionic lesion. Also, the ability of the child to hold his head suggests that the paravertebral muscles are functional as is true in postganglionic lesions.

Correct Answer: postganglionic lesion

1396. (1170) Q4-1534:

An 18-month-old boy is brought to your office for a clawing deformity of his right hand. The parents inform you that he was born full term after a difficult delivery complicated by shoulder dystocia. The boy weighed 9Â½ lbs at birth. The child had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the natal intensive care unit. Parents recall having noted a bump on his right clavicle, which was tender and was diagnosed as clavicle fracture. They also noticed a week later that the child did not flex the fingers of his right hand. The neonatologist had informed them that the fracture is managed conservatively and the absence of finger flexion is due to the fracture and shall recover. They were warned that the recovery can be prolonged and can take up to 2 years. The boy has grown well and has achieved his milestones on time. His immunization is complete for his age.

You find a healthy, playful boy who tends to use his left hand to reach for objects. His right hand has extension at all the metacarpophalangeal (MCP) joints of the fingers while his proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are flexed. His thumb is an adducted position and it is difficult to passively bring it to full abduction. There is obvious wasting of the hand and forearm. The child is able to move the arm well with no abnormalities noticed at the shoulder, elbow, and the wrist. The x-ray of his chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Horner Syndrome and the grasp reflex is absent.

Appropriate surgical management in this case should be:

1) Neurotization
3) Tendon transfers
2) Exploration and nerve grafting
4) Neurolysis

Neurotization has not been shown to produce successful results for lower root involvement and is performed for preganglionic lesions. At 18 months, exploration and nerve grafting must still be carried out. Neurolysis is reserved for cases in which the recovery is partial or plateaus. Tendon transfers in children younger than 3 years of age do not work as well. Younger children do not cooperate well in their rehabilitation and it is also difficult to decide upon the functioning motors for transfer.

Correct Answer: Exploration and nerve grafting

1397. (1171) Q4-1535:

An 18-month-old boy is brought to your office for a clawing deformity of his right hand. The parents inform you that he was born full term after a difficult delivery complicated by shoulder dystocia. The boy weighed 9Â½ lbs at birth. The child had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the natal intensive care unit. Parents recall having noted a bump on his right clavicle, which was tender and was diagnosed as clavicle fracture. They also noticed a week later that the child did not flex the fingers of his right hand. The neonatologist had informed them that the fracture is managed conservatively and the absence of finger flexion is due to the fracture and shall recover. They were warned that the recovery can be prolonged and can take up to 2 years. The boy has grown well and has achieved his milestones on time. His immunization is complete for his age.

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Which of the following set of investigations is most appropriate in this case:

1) Magnetic resonance imaging, electromyogram, histamine test
3) Computer tomography myelography, MRI, Somatosensory evoked potential
2) Manual muscle test (MMT), MRI, electromyogram
4) Somatosensory evoked potential, histamine test, EMG

In obstetric brachial palsies, it is important to confirm the level of lesion (pre- or postganglionic). Magnetic resonance imaging, computer tomography-myelogram or myelogram are comparable modalities. A manual muscle test is vital in documenting the muscle weakness as well as to assess progress on serial exams. SSEP is used intraoperatively and a histamine test usually does not form part of standard tests.

Correct Answer: Manual muscle test (MMT), MRI, electromyogram

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1398. (1172) Q4-1536:

An 18-month-old boy is brought to your office for a clawing deformity of his right hand. The parents inform you that he was born full term after a difficult delivery complicated by shoulder dystocia. The boy weighed 9Â½ lbs at birth. The child had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the natal intensive care unit. Parents recall having noted a bump on his right clavicle, which was tender and was diagnosed as clavicle fracture. They also noticed a week later that the child did not flex the fingers of his right hand. The neonatologist had informed them that the fracture is managed conservatively and the absence of finger flexion is due to the fracture and shall recover. They were warned that the recovery can be prolonged and can take up to 2 years. The boy has grown well and has achieved his milestones on time. His immunization is complete for his age.

You find a healthy, playful boy who tends to use his left hand to reach for objects. His right hand has extension at all the metacarpophalangeal (MCP) joints of the fingers while his proximal interphalangeal (PIP) and distal interphalangeal (DIP) joints are flexed. His thumb is an adducted position and it is difficult to passively bring it to full abduction. There is obvious wasting of the hand and forearm. The child is able to move the arm well with no abnormalities noticed at the shoulder, elbow, and the wrist. The x-ray of his chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Horner Syndrome and the grasp reflex is absent.

The goal of reconstructive surgery in this boy should include all of the following EXCEPT:

1) Thumb opposition
3) Thumb adduction
2) Widening of first web space
4) Thumb MP fusion

This child has already developed contractures of first web space, which probably will not respond to passive stretching. Fusion of MP joint is not needed as tendon transfers will be able to provide for lateral and tip pinch as well as opposition.

Correct Answer: Thumb MP fusion

1399. (1753) Q4-2150:

Which of the following lesions has the highest risk of malignant degeneration:

1) Maffucciâs syndrome
3) Solitary enchondroma
2) Ollierâs disease
5) None of the above
4) Multiple hereditary osteochondromatosis

Ollierâs disease (multiple enchondromatosis) is associated with deformities of the axial skeleton and larger, unilateral lesions. The combination of multiple enchondromatosis and venous-lymphatic vascular malformations (angiomas) is termed Maffucciâs syndrome. Maffucciâs syndrome is associated with a higher rate of degeneration into chondrosarcoma than in Ollierâs disease. Malignant change of solitary lesions is rare, but a sudden increase in pain or size should raise suspicion of degeneration.Correct Answer: Maffucciâs syndrome

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1400. (1754) Q4-2151:

The most common primary bone tumor of the hand is:

1) Enchondroma
3) Osteochondroma
2) Giant cell tumor
5) None of the above
4) Osteoid osteoma

Enchondromas account for more than 90% of primary bone tumors of the hand.Correct Answer: Enchondroma

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1401. (1755) Q4-2152:

Prolonged nonsteroidal anti-inflammatory drugs (NSAIDs) cure which of the following lesions:

1) Osteosarcoma
3) Osteoblastoma
2) Osteoid osteoma
5) None of the above
4) Osteochondroma

An average 33-month course of treatment with NSAIDs cures osteoid osteoma. The prostaglandin E2 in osteoid osteoma is likely the reason for this response.Correct Answer: Osteoid osteoma

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1402. (1756) Q4-2153:

The most common primary bone tumor in the hand is:

1) Enchondroma
3) Osteosarcoma
2) Osteochondroma
5) None of the above
4) Fibroma

Enchondroma preferentially occurs in the hand, most commonly in the phalanges and metacarpals, and is the most common primary tumor of bone found in the hand.Correct Answer: Enchondroma

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1403. (1757) Q4-2154:

Which of the following statements regarding ganglions is false:

1) Surgery can lead to a decrease in range of motion.
3) Needle aspiration is diagnostic and therapeutic, although the rate of recurrence is high after this procedure.
2) Ganglions are filled with mucinous fluid that does not transilluminate.
5) Ganglions may be multilobulated.
4) Volar ganglion may arise in relation to the radial artery.

Transillumination is a hallmark of ganglions. Because of the location from which ganglia arise and the dissection performed during resection, a decrease in range of motion can be seen postoperatively. Needle aspiration is diagnostic and can be therapeutic, however, recurrence rates as high as 95% have been reported. Volar ganglia can often be intimately associated with the radial artery. Ganglia may often be multilobulated.Correct Answer: Ganglions are filled with mucinous fluid that does not transilluminate.

1404. (1758) Q4-2155:

Dorsal wrist ganglions originate from the:

1) Scapholunate ligament
3) Extensor digitorum communis (EDC) tendon
2) Dorsal capsule
5) Capitolunate joint
4) Dorsal carpal ligament

Dorsal wrist ganglia do not arise from the dorsal capsule, EDC tendon, capitolunate joint, or dorsal intercarpal ligament. Dorsal wrist ganglia arise from the scapholunate ligament. Some surgeons advocate excising a small rim of the scapholunate ligament to avoid recurrence.Correct Answer: Scapholunate ligament

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1405. (1759) Q4-2156:

Ganglions of the distal interphalangeal (DIP) joints of the fingers are called:

1) Mucous cysts
3) Heberden nodes
2) Bouchard nodes
5) Retinacular cysts
4) Inclusion cysts

Ganglions arising at the DIP joints are called mucous cysts and ganglions from the flexor tendon in the palm are called retinacular cysts.

Bouchard nodes are osteophytes that develop at the proximal interphalangeal joint.

Heberden nodes are bony spurs at the dorsal aspect of the DIP joint and are present in osteoarthritis.

Inclusion cysts are mobile, nonadherent to skin, and can occur anywhere on a hand.

Correct Answer: Mucous cysts

1406. (1760) Q4-2157:

Management of a mucous cyst entails:

1) Aspiration with injection of hyaluronidase
3) Excision and resection of osteophytes
2) Aspiration only
5) Arthrodesis of the distal interphalangeal joint
4) Aspiration with injection of steroids

Treatment of mucous cysts, which are ganglions of the distal interphalangeal joint associated with osteoarthritic changes, entails excision of the cyst and osteophyte resection of fusion.

Aspiration only or aspiration of the cyst with injection of hyaluronidase is not indicated or efficacious in the treatment of mucous cysts because the osteophyte must be addressed. Injection of steroids also fails to address the underlying cause of these cysts. Arthrodesis of the distal interphalangeal joint is not necessary in the treatment of typical mucous cysts.Correct Answer: Excision and resection of osteophytes

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1407. (4047) Q4-2158:

A 30-year-old black woman presents with complaints of pain in the tip of her right index finger. The pain started approximately 6 months ago and becomes intense in cold weather. She also states that her nail on the index finger does not look as good as the others despite regular manicures. You notice a bluish discoloration and ridging of the nail. The nail is not split, but it appears clubbed. The patient does not have a history of respiratory or hemodynamic disease and appears healthy. The nail is exquisitely tender on pressure, but no mass is palpable. Two-point discrimination is intact and capillary refill is good. Radiographs do not reveal bony destruction, but you notice pressure indentation over the distal phalanx. The joint space is preserved, and the patient has full range of motion. The most likely diagnosis is:

1) Glomus tumor
3) Paronychia
2) Acute perinychia
5) Turret exostosis
4) Giant cell tumor

This patient presents with the classic triad of glomus tumor: sharp lancinating pain, point tenderness, and cold sensitivity. Localized bluish discoloration is also strongly suggestive of a glomus tumor.

Giant cell tumors can be found on the fingertip, however, a presentation of a giant cell tumor with these symptoms would be unusual. Mucous cysts would be part of the differential but does not cause a bluish discoloration or cold insensitivity. An acute paronychia would be painful and erythematous is infectious. A mucous cyst is not infectious. This classic triad does not describe a turret exotosis.Correct Answer: Glomus tumor

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1408. (1761) Q4-2159:

A 30-year-old black woman presents with complaints of pain in the tip of her right index finger. The pain started approximately 6 months ago and becomes intense in cold weather. She also states that her nail on the index finger does not look as good as the others despite regular manicures. You notice a bluish discoloration and ridging of the nail. The nail is not split, but it appears clubbed. The patient does not have a history of respiratory or hemodynamic disease and appears healthy. The nail is exquisitely tender on pressure, but no mass is palpable. Two-point discrimination is intact and capillary refill is good. Radiographs do not reveal bony destruction, but you notice pressure indentation over the distal phalanx. The joint space is preserved, and the patient has full range of motion. The next step in management includes:

1) Ordering a magnetic resonance image
3) Ordering a computed tomography scan
2) Ordering a bone scan
5) Injecting the distal phalanx medullary canal with corticosteroid
4) Performing an excisional biopsy

This is a classic case of a glomus tumor with cold intolerance and nail deformity. Imaging studies often are inconclusive, although computed tomography scans may show cortical reaction. This patient is symptomatic and should receive definitive treatment. It should be noted that magnetic resonance imaging is increasingly helpful for nonclassical presentations of finger pain.Correct Answer: Performing an excisional biopsy

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1409. (1762) Q4-2160:

A 30-year-old black woman presents with complaints of pain in the tip of her right index finger. The pain started approximately 6 months ago and becomes intense in cold weather. She also states that her nail on the index finger does not look as good as the others despite regular manicures. You notice a bluish discoloration and ridging of the nail. The nail is not split, but it appears clubbed. The patient does not have a history of respiratory or hemodynamic disease and appears healthy. The nail is exquisitely tender on pressure, but no mass is palpable. Two-point discrimination is intact and capillary refill is good. Radiographs do not reveal bony destruction, but you notice pressure indentation over the distal phalanx. The joint space is preserved, and the patient has full range of motion. Based on your clinical diagnoses, the histological findings will include which of the following:

1) Well-formed vascular channels with nonmyelinated nerve endings
3) Giant cells filled with inflammatory cells in the interstitium
2) Mucous islands with blood vessels
5) Amorphous calcium in pseudocapsule
4) Negatively birefringent cystals

Glomus tumors consist of well-formed vascular channels with nonmyelinated nerve endings. Glomus tumors are not associated with mucous islands or giant cells. Negatively birefringent crystals are found in patients with gout. The presentation of this patient does not suggest gout. Amorphous calcium in a pseudocapsule is diagnostic of calcinosis. Calcinosis occurs intracutaneoulsy or subcutaneously. These deposits can be tender but are not effected by changes in weather, as are glomus tumors.Correct Answer: Well-formed vascular channels with nonmyelinated nerve endings

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1410. (1763) Q4-2161:

Glomus tumors are characterized by all of the following except:

1) Three-quarters of glomus tumors occur in the hand.
3) Glomera are neuromyoarterial apparatuses that regulate sympathetic outflow.
2) Pain, point tenderness, and cold sensitivity are clinically present.
5) None of the above
4) Persistence of symptoms for more than 3 months after excision is suggestive of recurrence.

Glomera are neuromyoarterial apparatuses that regulate temperature.Correct Answer: Glomera are neuromyoarterial apparatuses that regulate sympathetic outflow.

1411. (1764) Q4-2162:

All of the following are characteristic of hemangiomas except:

1) 70% of hemangiomas are visible by 4 weeks of age
3) Hemangiomas are three times more common in woman than men
2) 70% of hemangiomas regress by 7 years of age
5) None of the above
4) All cavernous hemangiomas regress by 12 years of age

Cavernous hemangiomas are noninvoluting hemangiomas and require surgical excision.Correct Answer: All cavernous hemangiomas regress by 12 years of age

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1412. (1765) Q4-2163:

Pseudoaneurysms differ from true aneurysms in that:

1) Pseudoaneurysms are expansile.
3) Pseudoaneurysms have a fibrous wall.
2) Pseudoaneurysms occur secondary to trauma.
4) Pseudoaneurysms frequently occur in the ulnar artery.

Pseudoaneurysms occur secondary to penetrating trauma and have a fibrous wall, compared to true aneurysms that have all the elements of an arterial wall.Correct Answer: Pseudoaneurysms have a fibrous wall.

1413. (1766) Q4-2164:

Neurofibromas are characterized by all of the following except:

1) CafÃ©-au-lait spots
3) Dumbbell tumors
2) Axillary freckles
5) Characteristic oval avascular tumor in continuity with nerve trunk
4) Ease of surgical excision

Neurofibromas are benign tumors of neural origin that are transmitted as an autosomal dominant trait with variable penetrance. Neurofibromas are associated with cutaneous manifestations like cafe-au-lait spots and axillary freckles. They may be dumbbell shaped and can be identified with magnetic resonance imaging, which is especially helpful for deeper multiple lesions. They are infiltrative, making excision with preservation of peripheral nerve function difficult thus requiring bridge grafting for significant motor or sensory funtional requirements.Correct Answer: Ease of surgical excision

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1414. (1767) Q4-2165:

Recklinghausenâs disease is associated with all of the following except:

1) Diffuse neurofibromatosis
3) High potential for malignant degeneration
2) Schwannoma
5) None of the above
4) Plexiform growth

Diffuse neurofibromatosis is a separate clinical presentation and is not associated with Recklinghausenâs disease.Correct Answer: Diffuse neurofibromatosis

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1415. (1768) Q4-2166:

Schwannomas are differentiated from neurofibromas by all of the following except:

1) Ease of excision
3) Absence of fascicles
2) Eccentric location on the nerve
5) None of the above
4) Presence of schwann cells

Schwann cells contribute to schwannoma and neurofibroma.Correct Answer: Presence of schwann cells

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1416. (1769) Q4-2167:

All of the following are true for infantile digital fibroma except:

1) 80% of infantile digital fibroma cases appear by 1 year of age
3) Intracytoplasmic inclusion bodies are present
2) Infantile digital fibroma is exclusive to fingers and toes
5) Recurrent disease never implies malignant transformation
4) Wide local excision is curative

Eighty percent of infantile digital fibromata appear before a child's first birthday. They are exclusive to the fingers and toes and are usually painless. Infantile digital fibromata are often small and the same color as the skin. On histological examination, intracytoplasmic inclusion bodies are present. Although benign, the fibromata are locally aggressive. They do not metastaaize, but recurrences after wide local excision are common. Surgery is indicated when deformity or contracture is imminent.Correct Answer: Wide local excision is curative

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1417. (1770) Q4-2168:

Felon complications include all of the following except:

1) Phalangeal osteomyelitis
3) Collar button abscess
2) Suppurative flexor tenosynovitis
5) Nailbed deformity
4) Distal interphalangeal joint septic arthritis

Felons that are chronic or neglected may penetrate adjacent structures such as the distal phalanx, nailbed, or distal interphalangeal joint. They can also contribute to the formation of a pyogenic flexor tenosynovitis. Collar button abscesses are localized to web space. They typically arise from direct inoculation, not from distant felons.Correct Answer: Collar button abscess

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1418. (1771) Q4-2169:

Which of the following is not a classic Kanavel sign of flexor tenosynovitis:

1) Pain on passive extension
3) Tenderness of flexor sheath
2) Flexion attitude of the finger
5) Fusiform swelling of the entire finger
4) Anesthesia of the fingertip

The cardinal signs of flexor tenosynovitis described by Kanavel include pain on passive extension, flexion attitude of the finger, tenderness of flexor sheath, and swollen finger.Correct Answer: Anesthesia of the fingertip

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1419. (1772) Q4-2170:

Septic flexor tenosynovitis may involve all of the following areas except the:

1) Radial bursa
3) Paronaâs space
2) Thenar space
5) Ulnar bursa
4) Snuffbox

The radial and ulnar bursae are extensions of the tendon sheaths of the flexor pollicis longus and the flexor digitorum profundus of the small fingers. They can easily be involved in a case of pyogenic flexor tenosynovitis. Although not direct extensions of the flexor sheaths, the thenar space and Parona's space are adjacent to the flexor sheaths and can be involved in suppurative conditions. The snuffbox, however, does not have any contributions from the flexor system and is not usually involved in cases of pyogenic flexor tenosynovitis.Correct Answer: Snuffbox

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1420. (1773) Q4-2171:

Regarding the management of web space abscess, which of the following statements is not true:

1) Transverse incisions should be used.
3) Drains are often used following evacuation.
2) Wounds may be left open.
5) Thorough debridement of the dead muscle is required.
4) Early motion must be encouraged.

Transverse incisions can lead to contractures that limit finger abduction. Leaving wounds open allow for continued drainage. If preferred, closed suction drains can be used after closure of the wound. All devitalized tissue must be debrided and all signs of infection removed and irrigated copiously. Early motion is encouraged to prevent stiffness.Correct Answer: Transverse incisions should be used.

1421. (1774) Q4-2172:

Meleneyâs infection is a:

1) Spreading ulcer rimmed with gangrenous skin
3) Dry gangrene with superimposed infection
2) Patchy gangrenous involvement of the hand
5) Creates a sinus fistula to the midcarpal space
4) Multiple infective ulcer of the forearm

Found in necrotizing fasciitis, Meleneyâs infection is a spreading ulcer rimmed with gangrenous skin. The affected area must be debrided immediately. Cultures are taken at the time of surgery to tailor antibiotic coverage. Amputation is not unusual to control the spread of the gangrenous infection.Correct Answer: Spreading ulcer rimmed with gangrenous skin

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1422. (1775) Q4-2173:

Meleneyâs infection is caused by:

1) *Streptococcus viridans*
3) Microaerophyllic non-hemolytic streptococci
2) Aerobic hemolytic staphylococci
5) *Staphylococcus aureus*
4) B & C

Aerobic hemolytic staphylococci and microaerophyllic non-hemolytic streptococci synergistically act to produce Meleneyâs infection. Meleney's infection is a gangrenous infection that often results after a small injury. The infection is characterized by significant, rapid swelling with gangrenous changes.Correct Answer: B & C

1423. (1776) Q4-2174:

The most common pathogen for osteomyelitis of phalanges is:

1) *Staphylococcus aureus*
3) *Haemophilus influenzae*
2) Streptococci
5) *Pasturella multocida*
4) Mix of gram-negative and gram-positive organisms

Staphylococcus aureus is the most common pathogen that causes osteomyelitis in the hand. Most cases of osteomyelitis in the hand are due to direct extension. Other pathogens can be found if there is a contaminated injury that penetrates directly into the bone. *H. infuenza* , mixed pathogens, and *Pasturella multocida* are less likely causes of osteomyelitis and are often caused by direct inoculation injuries or bites.Correct Answer: *Staphylococcus aureus*

1424. (1777) Q4-2175:

The most common pathogen causing septic arthritis in the hand is:

1) *Staphylococcus aureus*
3) *Haemophilus influenzae*
2) Streptococci
5) Atypical mycobacterium
4) Mix of gram-negative and gram-positive organisms

Staphylococcus aureus is the most common pathogen that causes septic arthritis in the hand. The second most common pathogen is streptococcus species infections, which are often the result of trauma. Treatment includes incision and drainage with copius irrigation.Correct Answer: *Staphylococcus aureus*

1425. (1778) Q4-2176:

"Collar button" abscess refers to:

1) Web space infection
3) Extension of infection from mid-palmar space to Paronaâs space in the forearm
2) Finger pulp infection
5) Septic joint with dorsal and palmar extension
4) Eponychial infection

Collar button abscess is an infection of web space and is usually a result of penetrating trauma. Treatment of such abscesses requires incision and drainage through dorsal and palmar incisions. Care must be taken to avoid the neurovascular bundles. Finger pulp infections are known as felon. Infections involving Parona's space is typically involved in a horseshoe abscess. Eponychial infections are limited to the nail fold. Collar button abscesses do not include joint involvement.Correct Answer: Web space infection

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1426. (1779) Q4-2177:

A 35-year-old woman is bitten on her left index finger by a snake in her backyard. Management of snake bites includes all of the following except:

1) Keeping the patient emotionally and physically still
3) Identifying the snake
2) Applying a tourniquet
5) Call immediately for help
4) Injecting antivenin locally based on recommended guidelines

There are different snake bite protocols depending on the species of snake. However, common steps in all snake bite protocols include keeping the patient emotionally and physically still, calling for help immediately, applying a moderately tight tourniquet proximally to prevent further spread of venom, and capture or identification of the snake. Local injection of the antivenin in the fingers or toes is contraindicated.Correct Answer: Injecting antivenin locally based on recommended guidelines

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1427. (1780) Q4-2178:

Cardinal signs of evenomation include all of the following except:

1) Fang marks
3) Pain
2) Cyanosis
5) Ascending lymphangitis
4) Swelling

The cardinal signs of evenomation appear between 10 minutes and 4 hours after a person is bitten. The signs include fang marks, pain, swelling, and local necrosis. Cyanosis is not considered a cardinal sign of evenomation.Correct Answer: Cyanosis

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1428. (1781) Q4-2179:

All of the following nerves are involved in infection with *Mycobacterium leprae* except the:

1) Ulnar nerve at the elbow
3) Supraorbital nerve
2) Median nerve in the carpal tunnel
5) Spinal accessory nerve
4) Vagus nerve

Mycobacterium leprae causes skin, nerve, and tendon sheath infections. *M leprae* commonly affects the hands because it has a predilection for cool parts of the body. *M leprae* causes neuropathy, which frequently involves the ulnar nerve at the elbow and the median nerve at the wrist. The resulting limb deformities require various surgical procedures. Cranial nerves and autonomic nerves are not affected.Correct Answer: Vagus nerve

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1429. (1782) Q4-2180:

A 24-year-old white man presents to the emergency department. He was bitten on his fist while fighting with another man. You notice teeth marks on the dorsum of the metacarpophalangeal (MCP) joint of the right middle finger. The bite does not appear to be deep because the joint is not exposed, and you can see the extensor tendon, which seems intact. The patient has active extension at the MCP joint. The wound is red and swollen, but there is no tenderness or redness on the volar aspect of the MCP joint. The patient has some limitation in range of motion. He is afebrile. Radiographs reveal air in the joint but no joint dislocation or fracture, and there is no neurovascular deficit. All of the following are appropriate steps in the management of this patient except:

1) Injection of tetanus toxoid
3) Exploration for air in the joint
2) Closure of the wound
5) Splinting
4) Admitting the patient for observation and intravenous antibiotics

Human bite wounds on the hand are typically found over the MP joint. The mechanism of injury is a clenched-fist blow to the mouth. Oral flora enters the wound, which often communicates with the joint. *Eikenella corrodens* is frequently cultured from human bite wounds, but the most common pathogen is *staphylococcus aureus*. Appropriate treatment includes the administration of tetanus toxoid, exploration if there is air in the joint or frank infection, observation, intravenous antibiotics, arm elevation, and splinting. All bites over joints should be assumed to penetrate and require formal incision and drainage.Correct Answer: Closure of the wound

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1430. (1783) Q4-2181:

A 24-year-old man presents to the emergency department. He was bitten on his fist while fighting with another man. You notice teeth marks on the dorsum of the metacarpophalangeal (MCP) joint of the right middle finger. The bite does not appear to be deep because the joint is not exposed, and you can see the extensor tendon, which seems intact. The patient has active extension at the MCP joint. The wound is red and swollen, but there is no tenderness or redness on the volar aspect of the MCP joint. The patient has some limitation in range of motion. He is afebrile. Radiographs reveal soft tissue involvement but no joint dislocation or fracture, and there is no neurovascular deficit. An important step in assessment of human bites is:

1) Evaluation for tendon injury in clenched-fist position
3) Ultrasound to rule out septic arthritis
2) Bone scan to rule out osteomyelitis
5) None of the above
4) Monitoring finger girth to document progress

Evaluation for tendon injury in a clenched-fist position is essential because tendons slide proximally in the open-hand position. Involvement of tendon or joint usually necessitates surgical debridement.Correct Answer: Evaluation for tendon injury in clenched-fist position

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1431. (1784) Q4-2182:

A 24-year-old white man presents to the emergency department. He was bitten on his fist while fighting with another man. You notice teeth marks on the dorsum of the metacarpophalangeal (MCP) joint of the right middle finger. The bite does not appear to be deep because the joint is not exposed, and you can see the extensor tendon, which seems intact. The patient has active extension at the MCP joint. The wound is red and swollen, but there is no tenderness or redness on the volar aspect of the MCP joint. The patient has some limitation in range of motion. He is afebrile. Radiographs reveal soft tissue involvement but no joint dislocation or fracture, and there is no neurovascular deficit. After cultures are taken, the next important step in treatment is:

1) Debridement in the emergency department and suture
3) Admit and administer IV antibiotics
2) Single dose intravenous (IV) antibiotics and discharge on oral antibiotics with follow-up instructions
5) None of the above
4) Patient work up for human immunodeficiency virus

A patient with a human bite must be admitted for IV antibiotics and observation. If left untreated, human bites are commonly infected by a mixed flora of organisms. Therefore, they must be treated diligently.Correct Answer: Admit and administer IV antibiotics

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1432. (1785) Q4-2183:

A 24-year-old white man presents to the emergency department. He was bitten on his fist while fighting with another man. You notice teeth marks on the dorsum of the metacarpophalangeal (MCP) joint of the right middle finger. The bite does not appear to be deep because the joint is not exposed, and you can see the extensor tendon, which seems intact. The patient has active extension at the MCP joint. The wound is red and swollen, but there is no tenderness or redness on the volar aspect of the MCP joint. The patient has some limitation in range of motion. He is afebrile. Radiographs reveal soft tissue involvement but no joint dislocation or fracture, and there is no neurovascular deficit. The most appropriate antibiotic treatment includes:

1) Imipenam and ciprofloxacin
3) Amoxicillin and ciprofloxacin
2) Cefotaxime and ciprofloxacin
5) Bactrim and rifampin
4) Amoxicillin and flocloxacillin

Imipenam and ciprofloxacin provide treatment for gram-negative and gram-positive organisms.Correct Answer: Imipenam and ciprofloxacin

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1433. (1786) Q4-2184:

Which of the following organisms is most likely found in a cat bite:

1) *Eikenella corrodens*
3) *Micrococcus*
2) *Pasteurella multocida*
5) None of the above
4) *Borrelia recurrentis*

Pasteurella multocida is the most common organism found in animal bites.Correct Answer: *Pasteurella multocida*

1434. (1787) Q4-2185:

Which of the following is the atypical mycobacterium that infects a penetrating wound sustained in an aquatic environment:

1) *Mycobacterium avium*
3) *Mycobacterium aquaticum*
2) *Mycobacterium marinum*
5) *Mycobacterium chelorei*
4) *Mycobacterium tuberculosis hominis*

Tuberculosis is the most common chronic infection found in the hand. *Mycobacterium marinum* is the atypical mycobacterium that can infect a wound sustained in a marine environment, freshwater lake, or tropical fish tanks. It is also called swimming pool granuloma or fish tank granuloma.Correct Answer: *Mycobacterium marinum*

1435. (1788) Q4-2186:

Which of the following is not true for infections caused by *Mycobacterium marinum*:

1) Noncaseating granuloma is present.
3) Lowenstein-Jensen media can be used for cultures.
2) Minocycline is the preferred treatment.
5) It is also referred to as fish tank granuloma.
4) Painful swelling of digit, palm, or wrist is present with redness, warmth, and tenderness.

Tuberculous infections are chronic infections and do not produce acute signs of inflammation. Therefore, pain and tenderness are present in these infections but warmth and redness are absent. Abscesses produced in tuberculous infections are termed "cold abcesses."Correct Answer: Painful swelling of digit, palm, or wrist is present with redness, warmth, and tenderness.

1436. (1967) Q4-2379:

Which of the following fascial structures does not contribute to the formation of the spiral cord:

1) Pretendinous band
3) Graysonâs ligament
2) Lateral digital sheet
5) Spiral band
4) Clelandâs ligament

The pretendinous band, spiral band, lateral digital sheet, and Grayson's ligament are all parts of the normal fascia that contribute to the formation of the spiral cord. Cleland's ligament is not involved at all in the disease process.Correct Answer: Clelandâs ligament

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1437. (1968) Q4-2380:

Which of the following structures contribute to the formation of the spiral cord:

1) Pretendinous band, Graysonâs ligament, and Clelandâs ligament
3) Pretendinous band, Landsmeer ligament, and Graysonâs ligament
2) Pretendinous band, lateral digital sheet, and Graysonâs ligam
5) Cleland's ligament and Grayson's ligament
4) Pretendinous band, Landsmeer ligament, and natatory ligament

The spiral cord is formed from the pretendinous band, spiral band, Grayson's ligament, and lateral digital sheet. Cleland's ligament is not affected in Dupuytren's contracture. Remember that bands and ligaments give rise to cords, which are the diseased state.Correct Answer: Pretendinous band, lateral digital sheet, and Graysonâs ligam

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1438. (1969) Q4-2381:

Surgical release in Dupuytrenâs disease is indicated in which of the following:

1) A 15° metacarpophalangeal (MP) joint contracture and a 15° proximal interphalangeal (PIP) joint contracture
3) Palpable spiral cord involving ring and small fingers
2) A 15° MP joint contracture and a 0° PIP joint contracture
5) Palpable spiral cord involving ring and small fingers in both of the hands
4) Palpable spiral cord involving ring and small fingers with multiple skin pits

The indication for surgery in Dupuytrenâs disease is MP joint contracture larger than 30° and any degree of PIP joint deformity. The other answers are incorrect because they are subjective descriptions and do not necessarily indicate joint involvement.Correct Answer: A 15° metacarpophalangeal (MP) joint contracture and a 15° proximal interphalangeal (PIP) joint contracture

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1439. (1970) Q4-2382:

Skin pits in Dupuytrenâs disease are caused by:

1) Vertical septae of Legueu and Juvara
3) Longitudinal fibers of palmar aponeurosis inserting into the skin
2) Vertical fibers of palmar aponeurosis anchoring to the skin
5) Contractures of the natatory ligaments
4) Longitudinal pretendinous bands

The longitudinal fibers forming layer 1 of the palmar aponeurosis insert into the dermis and, when contracted, give rise to skin pits. The pretendinous bands give rise to the central cord. Contractures of the natatory ligament give rise to the natatory cord. Vertical fibers and septae do not give rise to pits.Correct Answer: Longitudinal fibers of palmar aponeurosis inserting into the skin

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1440. (1971) Q4-2383:

An otherwise healthy man has Dupuytrenâs disease, which involves his small finger with 40℞° proximal interphalangeal joint involvement. The preferred surgery in this patient is:

1) Partial fasciectomy
3) Arthroplasty
2) Arthrodesis
5) Fasciotomy with skin grafting
4) Osteotomy

A partial fasciectomy is the preferred surgery in this situation. It is recommended that involved fascial cords be resected rather than performing prophylactic fasciectomies. Care must be taken to preserve the neurovascular bundles. Arthrodesis, arthroplasty, and osteotomies are salvage procedures meant for recurrent disease. Fasciotomy has been recommended for elderly patients who cannot tolerate a long operation.Correct Answer: Partial fasciectomy

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1441. (1972) Q4-2384:

Marjolinâs ulcers are risk factors for which of the following tumors:

1) Squamous cell carcinoma
3) Melanoma
2) Basal cell carcinoma
5) Osteosarcoma
4) Synovial sarcoma

Marjolinâs ulcers are malignant degenerations in chronic skin ulcers, sinuses, and burn scars and are risk factors for squamous cell carcinoma. Any patient with chronic, nonhealing ulcers should undergo biopsy for malignant degeneration. Basal cell carcinoma, malignant melanoma, synovial sarcoma, and osteosarcoma are not commonly associated with Marjolin's ulcer.Correct Answer: Squamous cell carcinoma

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1442. (1973) Q4-2385:

Which of the following tumors rarely metastasizes:

1) Malignant melanoma
3) Clear cell carcinoma
2) Synovial sarcoma
5) Squamous cell carcinoma
4) Dermatofibrosarcoma protuberans

Dermatofibrosarcoma protuberans presents as a variably colored, slow-growing nodule involving the subcutaneous tissue. This tumor has a low incidence of metastasis; however, the recurrence rate is high even with wide local excision.Correct Answer: Dermatofibrosarcoma protuberans

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1443. (1974) Q4-2386:

Lymph node involvement is common in all of the following tumors except:

1) Sweat gland tumors
3) Melanoma
2) Squamous cell carcinoma
5) Merkel's cell carcinoma
4) Basal cell carcinoma

Basal cell carcinomas rarely metastasize. Malignant sweat gland tumors, malignant melanoma, and Merkel's cell carcinoma are aggressive. Treatment usually includes regional lymphadenectomy. Squamous cell carcinoma is one of the most common hand malignancies and has the capacity to metastasize via the lymphatics.Correct Answer: Basal cell carcinoma

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1444. (1975) Q4-2387:

Which of the following is not a characteristic of an acrolentiginous melanoma:

1) Involves palm and nail bed
3) Presents in older patients
2) Delays in diagnosis are common
5) Develops rapidly
4) Does not commonly metastasize

Acrolentiginous melanomas are usually flat, pigmented lesions. These melanomas often occur in older patients, affecting the palm and nail bed. At the time of presentation, acrolentiginous melanomas are frequently metastasized.Correct Answer: Does not commonly metastasize

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1445. (1976) Q4-2388:

Nevi at greatest risk for malignant degeneration are:

1) Giant congenital hair variety
3) Junctional nevi
2) Blue nevi
5) Nevus sebaceous
4) Compound nevi

Giant congenital hairy nevi, dysplastic nevi, senile lentigo, and congenital melanocytic nevi have significant risk for malignant degeneration.

Nevus sebaceous is present at birth in the head and neck region and has a 10% incidence of malignant transformation. Blue nevi, junctional nevi, and compound nevi have lower risks for transformation.Correct Answer: Giant congenital hair variety

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1446. (1977) Q4-2389:

All of the following are risk factors for malignant melanoma except:

1) Sunlight
3) Copper-based tanning lotions
2) Genetic predisposition
5) Immunosuppressive state
4) Atypical nevi

Sun exposure is the most important risk factor for melanoma. Family history, atypical nevi, and an immunosuppressive state increases an individual's risk for developing melanoma. It is unknown if tanning lotions cause malignant melanomas.Correct Answer: Copper-based tanning lotions

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1447. (1978) Q4-2390:

Which of the following statements is true regarding soft tissue sarcomas:

1) Soft tissue sarcomas frequently metastasize to bone.
3) Soft tissue sarcomas present as a painful mass in the hand.
2) Patients with soft tissue sarcomas of the hand have worse prognosis than patients with similar tumors in other extremities.
5) Soft tissue sarcomas can be "shelled out".
4) Overall prognosis is better with radical resection than wide excision.

Soft tissue sarcomas in the hand present as painless lesions, do not metastasize to bone, and although local control is better with radical resection, there is no improvement in overall survival when compared to wide excision. Soft tissue sarcomas should not be "shelled out."Correct Answer: Patients with soft tissue sarcomas of the hand have worse prognosis than patients with similar tumors in other extremities.

1448. (1979) Q4-2391:

Which of the following tumor metastasizes to lungs:

1) Squamous cell carcinoma
3) Soft tissue sarcoma
2) Basal cell carcinoma
5) Actinic keratosis
4) Schwannoma

Squamous cell carcinoma and basal cell carcinoma do not commonly metastasize to the lungs. Actinic keratoses are premalignant lesions that progress into squamous cell carcinomas. Schwannomas are common benign nerve tumors.Correct Answer: Soft tissue sarcoma

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1449. (1980) Q4-2393:

Which of the following is not a characteristic of synovial sarcomas:

1) Synovial sarcomas are poorly differentiated masses located close to joints, tendon, or bursa.
3) Lymphatic spread is common.
2) Spindle and epithelial-type cells with monophasic or biphasic cells are present on histology.
5) High grade malignant soft tissue sarcoma
4) Wide or radical excision with radiation or chemotherapy prevents metastases.

Synovial sarcomas are high grade malignant soft tissue sarcomas, in which metastases can occur years after surgery. Long term followup is necessary. They arise close to joints, tendons or bursa and lymphatic spred is common. Histology reveals spindle and epithelial type cells with menophasic or biphasic pattern. Treatment includes wide resection and radiation, chemotherapy is not usually used.Correct Answer: Wide or radical excision with radiation or chemotherapy prevents metastases.

1450. (1981) Q4-2394:

Characteristic histological features of malignant schwannoma are best described as:

1) Fusiform cells with neoplastic schwann cells and nerve fascicles
3) Round or fusiform cells with clear cytoplasm and nerve fascicles
2) Spindle and epithelial-type cell mix with monphasic or biphasic cells
5) None of the above
4) Pleomorphic spindle histiocytes and giant cells in a storiform pattern

The histological features of malignant schwannoma have characteristic fusiform cells with neoplastic schwann cells and nerve fascicles.Correct Answer: Fusiform cells with neoplastic schwann cells and nerve fascicles

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1451. (2163) Q4-2589:

Which of the following terms is not used in reference to macrodactyly:

1) Megalodactyly
3) Gigantism
2) Overgrowth
5) Macrodactylia fibrolipomatosis
4) Symbrachydactyly

Symbrachydactyly is a term that encompasses all variations of shortened digits. Symbrachydactyly may be associated with syndactylies, but it is not a term used in reference to macrodactyly.Correct Answer: Symbrachydactyly

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1452. (2164) Q4-2590:

Most cases of macrodactyly are:

1) Bilateral and affect men more often than women
3) Unilateral and affect men more often than women
2) Bilateral and affect women more often than men
5) Bilateral with equal frequency in both men and women
4) Unilateral and affect women more often than men

The majority of patients (90%) present with unilateral macrodactyly, and men are more often affected than women. Macrodactyly is most frequently found in the index finger, followed by the long finger, thumb, ring, and little fingers. Typically, two digits are affected â most commonly the thumb and index or the index and long.Correct Answer: Unilateral and affect men more often than women

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1453. (2165) Q4-2591:

Which digit is most commonly affected by macrodactyly:

1) Thumb
3) MIddle
2) Index
5) Small
4) Ring

The index finger is most frequently affected, although multiple digital enlargement is actually more commonly seen.Correct Answer: Index

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1454. (2166) Q4-2592:

Syndactyly is present in what percentage of patients with macrodactyly:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

The majority of patients (90%) present with unilateral macrodactyly, and men are more often affected than women. Macrodactyly is most frequently found in the index finger, followed by the long finger, thumb, ring, and little fingers. Typically, two digits are affected â most commonly the thumb and index or the index and long. Syndactyly may be present in 10% of patients with macrodactyly.Correct Answer: 10%

1455. (2167) Q4-2593:

Macrodactyly that is present at birth is termed:

1) Birth advancing macrodactyly (BAM)
3) Progressive macrodactyly
2) Static macrodactyly
5) Complex macrodactyly
4) Simple macrodactyly

Barsky described macrodactyly as either static or progressive. Static macrodactyly is present at birth, and the affected digit grows larger as the child develops. In the progressive type of macrodactyly, growth begins soon after birth. This form of the disorder is more common than static macrodactyly.Correct Answer: Static macrodactyly

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1456. (2168) Q4-2594:

The most accepted theory for the cause of macrodactyly is:

1) Idiopathic
3) Vascular
2) Neural
5) Congenital
4) Humoral

Some surgeons believe that macrodactyly is a variant of neurofibromatosis. Although macrodactyly is not an inherited anomaly, there are syndromes that may be associated with enlarged digits such as Proteus syndrome. Although numerous causes have been suggested, the most accepted theory was described by Inglis in 1950. He theorized that the abnormal nerves exert influence on the local tissues to stimulate growth.Correct Answer: Neural

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1457. (2169) Q4-2595:

Syndromes that may be associated with macrodactyly include:

1) Proteus syndrome
3) Madelungâs deformity
2) Freeman-Sheldon syndrome
5) Poland syndrome
4) Holt-Oram syndrome

Some surgeons believe that macrodactyly is a variant of neurofibromatosis. Although macrodactyly is not an inherited anomaly, there are syndromes that may be associated with enlarged digits such as Proteus syndrome. Theoretical causes for macrodactyly include a neural cause, a vascular cause, as well as a humoral mechanism. The most accepted theory is that abnormal nerves exert some influence on the local tissues to stimulate growth.Correct Answer: Proteus syndrome

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1458. (2170) Q4-2596:

Macrodactyly affects:

1) Only bones
3) Bones, fat, and nerves
2) Bones and fat
5) Bones, fat, nerves, blood vessels, and tendons
4) Bones, fat, nerves, and blood vessels

Although this is controversial, the majority of surgeons believe that macrodactyly affects bones, fat, and nerves.Correct Answer: Bones, fat, and nerves

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1459. (2171) Q4-2597:

A 2-year-old child is brought to your office for evaluation of a "big hand." Upon examination, you notice that the child has mildly enlarged ring and small fingers. There is full range of motion without instability. After examination of the patient, you recommend:

1) Scheduling the patient for immediate surgery
3) Performing surgery within 1 week of diagnosis
2) Telling the parents to return when the child develops functional abnormalities
5) Performing additional testing
4) Scheduling surgery to coincide with the patient beginning school

The child is not ready for surgery. Although surgery may coincide with the patient beginning school, this does not always occur. At this time, additional examination and testing are recommended.Correct Answer: Performing additional testing

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1460. (2172) Q4-2598:

A 2-year-old child is brought to your office for evaluation of a "big hand." Upon examination, you notice that the child has mildly enlarged ring and small fingers. There is full range of motion without instability. The childâs parents inform you that they would like you to amputate the affected digits as soon as possible. You should:

1) Begin radiation therapy to arrest the growth of the affected digits
3) Send the patient to another hand surgeon
2) Proceed with amputation because you have the parentsâ consent
5) Schedule the patient for a debulking procedure
4) Explain the typical course of macrodactyly and order additional testing

Although amputation may be necessary in some patients with macrodactyly, it is too early in the course of this case to begin entertaining such a drastic measure. A debulking procedure is not recommended for a 2-year-old child. Radiation therapy is not an option in uncomplicated cases of macrodactyly. The surgeon must educate the parents about the disease process and order additional testing.Correct Answer: Explain the typical course of macrodactyly and order additional testing

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1461. (2173) Q4-2599:

You discover that a patient who you have been treating for macrodactyly has been followed by the Proteus Syndrome Foundation. Exhaustive work-up has been completed and radiographs of the hand reveal:

1) Multiple enchondromas in the affected fingers
3) Enlarged bones in length and width
2) Enlarged bones in length only
5) Normal appearing bones
4) Enlarged bones in width only

In patients with macrodactyly, surgeons do not typically find enchondromas, especially not multiple enchondromas in the affected fingers. Enlargement of the bones is found in all dimensions â not only in the length and width. If the bones appear normal on radiograph, then they are not affected by macrodactyly.Correct Answer: Enlarged bones in length and width

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1462. (2174) Q4-2600:

A 2-year-old child is brought to your office for evaluation of a "big hand." Upon examination, you notice that the child has mildly enlarged ring and small fingers. There is full range of motion without instability. After examination of the patient, you discuss the diagnosis of macrodactyly with the parents. The parents feel assured after your discussion of the disease process and your review of the radiographs. You should next see the patient:

1) Never
3) When functional abnormalities develop
2) In 1 year
5) When the patient is old enough to consent for surgery
4) When the enlargement of the digits has ceased

Patients with macrodactyly should be followed up yearly. Although the parents may be difficult, this is not a reason to stop seeing a patient. The other answers choices are incorrect because treatment would be too late.Correct Answer: In 1 year

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1463. (2175) Q4-2601:

Which of the following is not a complication of macrodactyly surgery:

1) Nerve injury
3) Decreased sensation
2) Bony malunion
5) Infection
4) Joint laxity

Complications of macrodactyly surgery include poor healing of flaps secondary to devascularization or undue tension, nerve injury or decreased sensation, infection, stiffness, bony nonunion or malunion, and failure of the epiphysiodesis.Correct Answer: Joint laxity

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1464. (2176) Q4-2602:

Epiphysiodesis for macrodactyly should be performed at the following location:

1) Proximal phalanx only
3) Proximal phalanx, middle phalanx, and distal phalanx
2) Proximal phalanx and middle phalanx
5) Proximal phalanx and distal phalanx
4) Middle phalanx only

Treatment by epiphysiodesis for macrodactyly is ineffective if only single phalanges are treated. Therefore, treatment of the proximal phalanx, distal phalanx, or the middle phalanx alone is incorrect. The author prefers to perform epiphysiodesis only on the proximal and distal phalanges. The middle phalanx is not treated to preserve motion at the proximal interphalangeal joint.Correct Answer: Proximal phalanx and distal phalanx

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1465. (2187) Q4-2614:

When ruptured, which portion of the scapholunate ligament leads to scaphoid-lunate diastasis:

1) Distal
3) Intermediate
2) Proximal
5) Volar
4) Dorsal

The dorsal section of the scapholunate ligament is the strongest portion, requiring 300 N of load for failure. The volar *(*150 N) and intermediate portions *(*25 N to 50 N) contribute less to overall stability.Correct Answer: Dorsal

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1466. (2188) Q4-2615:

Which of the following radiographic views is not routinely used to diagnose scapholunate injury:

1) Semisupination oblique view
3) Lateral view
2) Clenched fist view
5) Oblique view
4) Anteroposterior (AP) view

The semisupination oblique view is used to visualize the pisiform and pisotriquetral joint. The PA oblique and lateral views are the primary films used to diagnose scapholunate instability. The clenched fist view is used as a provocative view to bring out dynamic instability.Correct Answer: Semisupination oblique view

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1467. (2189) Q4-2616:

Which of the following treatments is not used for acute scapholunate ligament ruptures:

1) Open repair with bone sutures
3) Closed reduction and long arm cast
2) Proximal row carpectomy
5) Open repair with suture anchors
4) Arthroscopically assisted reduction and pinning

Proximal row carpectomy is a salvage procedure for chronic instability with focal radioscaphoid arthritis. Open repair with sutures through bone tunnels, open repair with suture anchors, and arthroscopically assisted reduction and pinning have been used successfully in acute cases.Correct Answer: Proximal row carpectomy

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1468. (2190) Q4-2617:

Which of the following is considered indicative of a scaphoid-lunate ligament tear on posteroanterior radiograph:

1) Terry Thomas sign
3) Spilled tea cup sign
2) Volar intercalated segmental instability (VISI) pattern
5) Dorsal intercalated segment instability (DISI) pattern
4) Watson-Jones scaphoid shift

The VISI, DISI, and spilled tea cup signs are seen on lateral radiographs, whereas the Watson-Jones scaphoid shift test is a clinical sign. The classic pattern after scaphoid-lunate ligament injury is a DISI pattern as the lunate extends and the scaphoid flexes. The spilled tea cup sign is present in perilunate dislocations.Correct Answer: Terry Thomas sign

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1469. (2191) Q4-2618:

The Terry Thomas sign, which is considered indicative of scaphoid-lunate ligament rupture, is best described as:

1) Scapholunate diastases larger than 3 mm
3) Reduction and exaggeration of scapholunate diastases on radial and ulnar deviation motion studies
2) Scapholunate angle more than 30Âº to 60Âº on lateral radiographs
5) Scaphoid flexion with lunate extension
4) Exaggeration and reduction of scaphoid-lunate diastases on radial and ulnar deviation radiographs, respectively

The Terry Thomas sign refers to scapholunate diastases that may be apparent on posteroanterior radiographs of the wrist and is indicative of rupture if the diastases are larger than 3 mm. It is named after the famous comedian who had a gap between his front teeth.Correct Answer: Scapholunate diastases larger than 3 mm

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1470. (2192) Q4-2619:

The most important requirement for a diagnostic magnetic resonance image (MRI) study in cases of scaphoid-lunate ligament injury is:

1) 2 mm thin slices
3) Gallium-enhanced scan
2) Tangential cuts
5) MRI in neutral, radial, and ulnar deviation
4) Dedicated wrist coil

MRI is not considered the technique of choice for the evaluation of the scaphoid-lunate ligament. Standard MRI coils are not adequate for the evaluation of the ligaments of the wrist. To maximize the yield from a wrist MRI, high-field strength and high-resolution images must be obtained using dedicated wrist coils. Only with such dedicated coils can detailed information be derived regarding the continuity of the scapoid-lunate ligament. Physical examination and wrist arthroscopy remain the gold standards for the evaluation of a torn scaphoid-lunate ligament.Correct Answer: Dedicated wrist coil

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1471. (2193) Q4-2620:

In cases of subacute scaphoid-lunate ligament injury with no arthrosis, all of the following are acceptable options except:

1) Herbert screw (reduction association of the scapholunate)
3) Scaphoid-lunate ligament reconstruction using bone-ligament-bone autograft
2) Scaphotrapeziotrapezoid (STT) fusion
5) Repair with capsulodesis
4) Allograft ligament

In cases of subacute scaphoid-lunate ligament injury without arthrosis, it is acceptable to attempt reconstruction with bone anchors, allograft ligament repair, capsulodesis, bone-ligament-bone autograft, and the RASL procedure with a Herbert screw. In the presence of localized arthritis, one might consider one of the limited wrist fusions such as scaphotrapeziotrapezoid fusion.Correct Answer: Scaphotrapeziotrapezoid (STT) fusion

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1472. (2317) Q4-2770:

Mallet finger injuries refer to:

1) Fractures of the bony tuft
3) Lack of conjoined tendon continuity at the distal interphalangeal (DIP) joint
2) Flexor tendon injuries
5) Intrinsic tightness
4) Fractures of the middle phalanx

Mallet finger injuries may be associated with fractures of the bony tuft, fractures of the middle phalanx, flexor tendon injuries, and intrinsic tightness. However, mallet injuries refer to lack of continuity at the DIP joint.Correct Answer: Lack of conjoined tendon continuity at the distal interphalangeal (DIP) joint

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1473. (2318) Q4-2772:

In mallet finger injuries, the distal phalanx posture is:

1) Hyperextended
3) Neutral
2) Flexed
5) Ulnarly deviated
4) Radially deviated

The characteristic deformity is âdroopingâ at the distal interphalangeal (DIP) joint. The DIP is flexed. It is not hyperextended, neutral, or deviated.Correct Answer: Flexed

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1474. (2319) Q4-2773:

Mallet finger injuries are typically:

1) Secondary to hyperextension injuries
3) Secondary to torsion injuries
2) Secondary to forced flexion injuries
5) Asymptomatic
4) Secondary to fingertip amputations

Mallet finger usually results from a blow to the tip of the extended finger. This forces distal phalanx flexion and disruption of the extensor mechanism at the distal interphalangeal joint. Open injuries to the extensor mechanism can also cause mallet finger.Correct Answer: Secondary to forced flexion injuries

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1475. (2320) Q4-2774:

Treatment of a type I mallet finger is typically closed. This involves:

1) Cast immobilization of the affected digit in extension
3) Early active motion of the affected joint
2) Dorsal block splint of the affected digit
5) Splinting of the affected DIP joint in extension
4) Splinting of the affected distal interphalangeal joint (DIP) joint in flexion

Cast immobilization is excessive and will cause undue stiffness in the affected finger. Dorsal blocking splints, splinting in flexion, and early active motion are contraindicated in these injuries. Only the affected joint should be splinted in extension.Correct Answer: Splinting of the affected DIP joint in extension

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1476. (2321) Q4-2775:

Type I mallet finger injuries must be immobilized constantly for a minimum of:

1) 4 weeks
3) 6 weeks
2) 5 weeks
5) 8 weeks
4) 7 weeks

Eight weeks of immobilization is preferred. If the finger is immobilized for a shorter period of time, the clock is reset and immobilization is started again.Correct Answer: 8 weeks

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1477. (2323) Q4-2777:

The most common mallet finger injuries are:

1) Type I
3) Type III
2) Type II
5) Type V
4) Type IV

Type I mallet injuries are by far the most common mallet injuries. There is no such classification as a type V injury.Correct Answer: Type I

1478. (2324) Q4-2778:

On physical examination, a mallet finger assumes a:

1) Resting flexed posture with active and passive extension
3) Resting flexed posture without active extension
2) Resting flexed posture without passive extension
5) Resting flexed posture with active extension
4) Resting flexed posture without active or passive extension

The distal phalanx assumes a resting flexed posture. The patient is not able to actively extend the fingertip, but it can be passively extended.Correct Answer: Resting flexed posture without active extension

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1479. (2325) Q4-2779:

The following mallet finger injuries always require tendon repair:

1) Type I and type II
3) Type III and type IV
2) Type II and type III
5) Type I and type IV
4) Type IV and type V

Type II and III injuries have absolute requirements for tendon repair as there is a laceration or loss of tendon substance.Correct Answer: Type II and type III

1480. (2326) Q4-2780:

After placing a type I mallet finger in a splint at the initial visit, next follow-up should be:

1) The following day
3) In 2 weeks
2) In 1 week
5) At the end of the 8-week regimen
4) In 1 month

After placement of the splint, the patient should follow-up in the next week to make sure the finger is still maintained in full extension. Loosening of the splint will occur as swelling decreases.Correct Answer: In 1 week

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1481. (2335) Q4-2792:

The most common bone tumor of the upper extremity is:

1) Enchondroma
3) Osteochondroma
2) Osteoblastoma
5) Chondromyxoid tumor
4) Giant cell tumor

Osteochondromas are the most common primary benign bony tumors.Correct Answer: Osteochondroma

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1482. (2336) Q4-2793:

The most common benign bone tumor of the hand is:

1) Enchondroma
3) Osteochondroma
2) Osteoblastoma
5) Chondromyxoid tumor
4) Giant cell tumor

Unlike the entire upper extremity, enchondromas are the most common tumors of the hand.Correct Answer: Enchondroma

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1483. (2337) Q4-2794:

Osteochondromas are benign but can have a malignant transformation in which of the following cases:

1) Diaphyseal achalasia
3) Osteochondromatosis malignant transformans
2) Ollierâs disease
5) Mafucci's syndrome
4) Osteochondroma larger than 5 cm

Diaphyseal achalasia, also known as multiple hereditary exostoses, has a risk of malignant degeneration in up to 25% patients. Ollierâs disease and Mafucciâs syndrome are associated with enchondromas. There is no lesion called an osteochondromatosis malignant transformans.Correct Answer: Diaphyseal achalasia

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1484. (2338) Q4-2795:

The risk of malignant transformation in patients with multiple hereditary exostoses is:

1) 0%
3) 1% to 2%
2) Less than 1%
5) 0.5% to 25%
4) Greater than 5%

The rate of malignant transformation in patients with multiple hereditary exostoses is variable and is generally reported between 0.5% to 25%.Correct Answer: 0.5% to 25%

1485. (2339) Q4-2796:

Recurrence of osteochondroma is likely if:

1) The cartilage cap is incompletely excised
3) The bony stalk is incompletely excised
2) The overlying bursa is incompletely excised
5) Its connection with the medullary canal is not obliterated
4) The tumor is incompletely excised

The cartilaginous portion of an osteochondroma is the neoplastic part; its complete excision is essential to avoid recurrences.Correct Answer: The cartilage cap is incompletely excised

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1486. (2340) Q4-2797:

Malignant transformation of osteochondroma commonly occurs to:

1) High-grade osteosarcoma
3) Low-grade chondrosarcoma
2) High-grade chondrosarcoma
5) Parosteal osteosarcoma
4) Low-grade osteosarcoma

Osteochondroma is a cartilaginous tumor and malignant transformation is to a low-grade chondrosarcoma.Correct Answer: Low-grade chondrosarcoma

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1487. (2341) Q4-2798:

All of the following suggest a possibility of malignant transformation in multiple hereditary exostoses except:

1) Recent onset of pain
3) Cartilaginous cap thickness greater than 3 cm
2) Growth after skeletal maturity
5) Calcific stippling in the cap on radiograph
4) Soft tissue extension

Stippling on radiographs in the cap is due to calcification and is a common characteristic of cartilaginous tumors.Correct Answer: Calcific stippling in the cap on radiograph

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1488. (2342) Q4-2799:

Enchondromas are commonly involved in which of the following sites:

1) Metacarpals
3) Radius
2) Carpus
5) Clavicle
4) Ulna

Metacarpals and phalanges are the most common areas of hand involvement, and the hand is involved in 40% to 65% of cases. Enchondromas are also the most common primary benign bone tumor of the hand (90% cases).Correct Answer: Metacarpals

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1489. (2343) Q4-2800:

The most common forearm deformity in patients with hereditary multiple osteochondromatosis is:

1) Ulnar shortening
3) Radial head dislocation
2) Radial shortening
5) Translocation of carpus
4) Madelungâs deformity

Ulnar involvement and shortening frequently occurs in patients with hereditary multiples osteochondromatosis because the distal ulnar growth plate is smaller than that of the radius, consequently its length is affected more. The ulnar shortening causes radial bowing or radial head dislocation.Correct Answer: Ulnar shortening

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1490. (2344) Q4-2801:

Slide 1

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the patientâs forearm. The anteroposterior radiograph is shown (Slide). The next step is to order a:

1) Skeletal radiograph survey
3) Magnetic resonance imaging (MRI) with wrist arthrogram
2) Magnetic resonance imaging (MRI)
5) Computed tomography (CT) scan
4) Genetic evaluation

The next step is to order a skeletal survey to rule out involvement of other areas.Correct Answer: Skeletal radiograph survey

1491. (2345) Q4-2802:

Slide 1

Slide 2

Slide 3

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

An immediate appointment for magnetic resonance imagine (MRI) and computed tomography (CT) scan are not available, and a genetic evaluation has been carried out previously. As you await the report from the geneticist office, you decide to get a skeletal radiograph series on the patient. The radiograph of the opposite forearm (Slide 1) and right leg are shown (Slide 2).

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 3).

Your suspected diagnosis is:

1) Diaphyseal achalasia
3) Multiple enchondromatosis
2) Madelungâs deformity
5) Infection
4) Multiple epiphyseal dysplasia

Diaphyseal achalasia, also called multiple hereditary exostoses, classically presents in a young individual with multiple sites of involvement. The more involved the disease, the more likely hand involvement becomes. Forearm involvement is also common. The radius is bowed due to the shortened ulna. The risk of radial head dislocation is higher if the radius does not bow. While infection or traumatic injury could have produced early physeal arrest as seen in the first radiograph, presence of lesions elsewhere indicates multiple hereditary exostoses and should be investigated with skeletal surveys. Multiple epiphyseal dysplasia is not a possible diagnosis as only the ulna is involved in the first radiograph and radius alone in the left forearm. No enchondromas are present.Correct Answer: Diaphyseal achalasia

1492. (2346) Q4-2803:

Slide 1

Slide 2

Slide 3

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

The genetic pattern seen in patients with this type of presentation is:

1) Autosomal recessive
3) Sex-linked recessive
2) Autosomal dominant
5) Sporadic
4) Sex-linked dominant

Multiple hereditary exostoses is inherited in an autosomal-dominant manner with 90% penetrance.Correct Answer: Autosomal dominant

1493. (2347) Q4-2804:

Slide 1

Slide 2

Slide 3

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

Which of the following areas is unlikely to be involved:

1) Phalanges
3) Clavicle
2) Pelvis
5) Talus
4) Femur

The clavicle is a membranous bone, and osteochondromas do not arise in membranous bones.Correct Answer: Clavicle

1494. (4053) Q4-2805:

Slide 1 **Slide 2** **Slide 3**

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

The chance of hand involvement in this child is:

1) 0%
3) 25%
2) 10%
5) Undetermined
4) Greater than 25%

The hand is involved in 30% to 80% of cases.Correct Answer: Greater than 25%

1495. (2348) Q4-2806:

Slide 1 **Slide 2** **Slide 3**

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

The most likely complication in this child is:

1) Malignant degeneration
3) Posterior interosseous neuropathy (PIN) palsy
2) Carpal translocation
5) Elbow dislocation
4) Peroneal nerve palsy

Ulnar carpal translocation occurs due to the steep radial articular angulation that occurs due to the tethering effect of a shortened ulna and is already apparent in early stages in the first radiograph. While peroneal palsy is possible due to a proximal fibula lesion, it is less common. Malignant transformation occurs, risk varies with families.Correct Answer: Carpal translocation

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1496. (2349) Q4-2807:

Slide 1 **Slide 2** **Slide 3**

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

The difference between Madelungâs deformity and this boyâs condition is:

1) The ulna is shorter
3) There is radial head dislocation
2) The radius is shorter
5) It is not congenital
4) There is bilateral involvement

The ulna is elongated or dorsally subluxed in Madelung's deformity.Correct Answer: The ulna is shorter

1497. (2350) Q4-2808:

Slide 1

Slide 2

Slide 3

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

All of the following are acceptable options, either alone or in combination, for management of this childâs condition, except:

1) Excision of osteochondromas
3) Hemiphyseal stapling
2) Ulnar lengthening
5) Observation
4) Radial osteotomy

Although hemiphyseal stapling is an acceptable option to correct radial articular angulation, in this boy the distal radial physis is already fused as is seen in the first radiograph.Correct Answer: Hemiphyseal stapling

1498. (2351) Q4-2809:

Slide 1

Slide 2

Slide 3

A 12-year-old boy is brought to the clinic by his concerned parents. The boyâs forearm is bowed, and his parents are confused as to the possible diagnosis and treatment options. You notice that the right forearm of the child is bowed ulnarwards and is shorter compared to the left forearm. The pronosupination is markedly decreased on the right side but is also limited on the left side. The patient has a good grip, pinch, and grasp. He is neurologically intact as well.

The parents say that they first noticed the deformity around 6 or 7 years ago, and the mother informs you that she had noticed a hard bump on the forearm. She has recently noticed another bump on his right leg. The child does not complain of pain and is using both of his hands quite well. The parents were informed by a previous physician that the child has Madelungâs deformity and are concerned that the disease is now involving other areas of his body.

You order a radiograph of the forearm. The anteroposterior radiograph is shown (Slide 1). The childâs skeletal radiograph survey is also presented (Slide 2 and Slide 3).

Which of the following is not true regarding the possibility of malignant degeneration in this child:

1) There is a risk of up to 25%
3) Most common secondary malignancy is chondrosarcoma
2) Bone scan can differentiate
5) Malignant change occurs in adulthood
4) Risk of malignancy varies between families

Bone scan cannot differentiate between an active lesion and a malignant transformation.Correct Answer: Bone scan can differentiate

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1499. (2352) Q4-2810:

Hornerâs syndrome includes all of the following except:

1) Miosis
3) Enophthalmosis
2) Anhidrosis
5) Diplopia
4) Exophthalmosis

Hornerâs syndrome is caused by disruption of sympathetic innervation and is characterized by enophthalmosis, not exophthalmosis. Other symptoms include anhidrosis, miosis, and ptosis.

Correct Answer: Exophthalmosis

1500. (2353) Q4-2811:

Axonotmesis involves injury to the:

1) Epineurium
3) Perineurium
2) Endoneurium
5) Vasonervorum
4) Axon

Axontmesis, as described in Seddonâs classification, implies injury to the axon and myelin sheath. Neurontmesis involves injury to all three layers.

Correct Answer: Axon

1501. (2354) Q4-2812:

All of the following may be seen with preganglionic lesion except:

1) Hornerâs syndrome
3) Positive histamine test
2) Hemidiaphragmatic palsy
5) Root avulsion sleeve on myelogram
4) Tinelâs sign

Tinelâs sign is seen with postganglionic lesions.

Correct Answer: Tinelâs sign

1502. (2355) Q4-2813:

Weakness is not seen with root avulsion in the:

1) Rhomboids
3) Supraspinatus
2) Serratus anterior
5) Infraspinatus
4) Trapezius

The trapezius is innervated by spinal accessory nerve and thus will not be involved in a brachial plexus lesion. In the case of a preganglionic lesion, all muscles innervated by the nerve roots will be affected.

Correct Answer: Trapezius

1503. (2356) Q4-2814:

In obstetric brachial plexus injury, an indicator of plexus recovery at 3 months is the return of the:

1) Biceps muscle
3) Brachioradialis muscle
2) Triceps muscle
5) Teres major muscle
4) Latissimus muscle

Biceps recovery at 3 months is the single most important indicator of recovery in obstetric plexus palsy.

Correct Answer: Biceps muscle

1504. (2357) Q4-2815:

A 15-year-old boy presented with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and twisted his neck. Radiographs of the skull, chest, cervical and thoracic spine, and shoulder were normal. There was no loss of consciousness, chest pain, or breathing difficulties. The patient was observed in the hospital until stable and referred for follow-up in the hand clinic at 4 weeks. An electromyelogram (EMG) was scheduled. Clinical examination revealed weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature was preserved and he could grasp, release, and pinch. Sensations were decreased along the distribution of the axillary nerve. There was 3 cm wasting of his arm and 2 cm of the forearm. Tinelâs sign is positive around the clavicle. Hornerâs signs are absent and his arm lies against the body. The EMG report showed fibrillation potentials in the weak muscles. The patient can now flex his elbow. When asked to demonstrate, he flexes his wrist and pronates his forearm to swing his elbow into flexion.

Diagnosis of the condition is:

1) Brachial plexus neuropraxia
3) Brachial plexus neuritis
2) Erbâs palsy
5) Klumpkeâs Palsy
4) C5, C6 disk herniations

The involved muscles have C5, C6 root innervations. Positive Tinelâs sign, functioning rhomboids and serratus anterior, and the absence of Hornerâs syndrome rule out a preganglionic lesion. The EMG finding confirms the clinical finding. Subclinical involvement of any other muscle is not shown. Neuropraxia usually recovers in 6 weeks and EMG shows fibrillation, which is inconsistent with neuropraxia. Brachial plexus neuritis, Parsonage-Turner syndrome, has an acute presentation following a painful episode involving the whole arm. There is significant history of a fall in this case.

Correct Answer: Erbâs palsy

1505. (2358) Q4-2816:

A 15-year-old boy presented with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and twisted his neck. Radiographs of the skull, chest, cervical and thoracic spine, and shoulder were normal. There was no loss of consciousness, chest pain, or breathing difficulties. The patient was observed in the hospital until stable and referred for follow-up in the hand clinic at 4 weeks. An electromyelogram (EMG) was scheduled. Clinical examination revealed weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature was preserved and he could grasp, release, and pinch. Sensations were decreased along the distribution of the axillary nerve. There was 3-cm wasting of his arm and 2 cm of the forearm. Tinelâs sign is positive around the clavicle. Hornerâs signs are absent and his arm lies against the body. The EMG report showed fibrillation potentials in the weak muscles. The patient can now flex his elbow. When asked to demonstrate, he flexes his wrist and pronates his forearm to swing his elbow into flexion.

The level of lesion is:

1) Postganglionic C5, C6
3) Posterior cord injury
2) Preganglionic C5, C6
5) Spinal accessory paralysis
4) Middle trunk

The involved muscles have C5, C6 root innervations. Positive Tinelâs sign, functioning rhomboids and serratus anterior, and the absence of Hornerâs syndrome rule out a preganglionic lesion. The EMG finding confirms the clinical finding. Subclinical involvement of any other muscle is not shown. Neuropraxia usually recovers in 6 weeks and EMG shows fibrillation, which is inconsistent with neuropraxia. Brachial plexus neuritis, Parsonage-Turner syndrome, has an acute presentation following a painful episode involving the whole arm. There is significant history of a fall in this case.

Correct Answer: Postganglionic C5, C6

1506. (2359) Q4-2817:

A 15-year-old boy presented with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and twisted his neck. Radiographs of the skull, chest, cervical and thoracic spine, and shoulder were normal. There was no loss of consciousness, chest pain, or breathing difficulties. The patient was observed in the hospital until stable and referred for follow-up in the hand clinic at 4 weeks. An electromyelogram (EMG) was scheduled. Clinical examination revealed weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature was preserved and he could grasp, release, and pinch. Sensations were decreased along the distribution of the axillary nerve. There was 3 cm wasting of his arm and 2 cm of the forearm. Tinelâs sign is positive around the clavicle. Hornerâs signs are absent and his arm lies against the body. The EMG report showed fibrillation potentials in the weak muscles. The patient can now flex his elbow. When asked to demonstrate, he flexes his wrist and pronates his forearm to swing his elbow into flexion.

The least helpful test in further management of this patient is:

1) Magnetic resonance imaging (MRI)
3) Repeat electromyelogram (EMG) after 4 weeks
2) Computed tomography (CT) scan of the neck
5) Careful neurological examination
4) Somatosensory evoked potential (SSEP)

Computed tomography scan of the cervical spine will not show the pseudomeningoceles nor provide any information on brachial plexus. Computed tomography may be needed in case of a suspected neck injury but does not form part of a brachial plexus work up.

Correct Answer: Computed tomography (CT) scan of the neck

1507. (2360) Q4-2818:

A 15-year-old boy presented with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and twisted his neck. Radiographs of the skull, chest, cervical and thoracic spine, and shoulder were normal. There was no loss of consciousness, chest pain, or breathing difficulties. The patient was observed in the hospital until stable and referred for follow-up in the hand clinic at 4 weeks. An electromyelogram (EMG) was scheduled. Clinical examination revealed weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature was preserved and he could grasp, release, and pinch. Sensations were decreased along the distribution of the axillary nerve. There was 3 cm wasting of his arm and 2 cm of the forearm. Tinelâs sign is positive around the clavicle. Hornerâs signs are absent and his arm lies against the body. The EMG report showed fibrillation potentials in the weak muscles. The patient can now flex his elbow. When asked to demonstrate, he flexes his wrist and pronates his forearm to swing his elbow into flexion.

The plan of management in this patient 5 months postinjury with no clinical improvement should be:

1) Neurotization
3) Continued observation
2) Exploration and nerve grafting
5) Shoulder arthrodesis
4) Tendon transfers

Neurotization is appropriate in preganglionic lesions. If at 6 months a patient shows no evidence of recovery, it is time for plexus exploration. Further observation will not change the picture. Tendon transfers are reconstructive procedures, which are done at a later stage.

Correct Answer: Exploration and nerve grafting

1508. (2361) Q4-2819:

A 15-year-old boy presented with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle 8 weeks ago. He landed on the right shoulder and twisted his neck. Radiographs of the skull, chest, cervical and thoracic spine, and shoulder were normal. There was no loss of consciousness, chest pain, or breathing difficulties. The patient was observed in the hospital until stable and referred for follow-up in the hand clinic at 4 weeks. An electromyelogram (EMG) was scheduled. Clinical examination revealed weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature was preserved and he could grasp, release, and pinch. Sensations were decreased along the distribution of the axillary nerve. There was 3 cm wasting of his arm and 2 cm of the forearm. Tinelâs sign is positive around the clavicle. Hornerâs signs are absent and his arm lies against the body. The EMG report showed fibrillation potentials in the weak muscles. The patient can now flex his elbow. When asked to demonstrate, he flexes his wrist and pronates his forearm to swing his elbow into flexion.

The most important indication for early exploration in this patient is:

1) Absence of biceps function at 3 months
3) Presence of trick movements
2) Absence of biceps function with return of extensor carpi radialis longus (ECRL) power at 4 months
5) Weakness of the supraspinatus
4) Subluxation of humeral head on radiographs

An important indication for early exploration is the recovery of a distally supplied muscle, ECRLâC6, in the absence of a proximally supplied muscle, bicepsâC5. Trick movements are adaptive movements employed by the patient by recruiting other muscles, for example, the use of flexor-pronator as elbow flexors in this patient. Bony deformity is a late sequelae and biceps recovery at 3 months is important in obstetric brachial palsy.

Correct Answer: Absence of biceps function with return of extensor carpi radialis longus (ECRL) power at 4 months

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1509. (2362) Q4-2820:

A 15-year-old boy presented with inability to elevate his right shoulder and flex his elbow. He sustained a fall from an all-terrain vehicle eight weeks prior. He landed on the right shoulder and twisted his neck. Radiographs of the skull, chest, cervical and thoracic spine, and shoulder were normal. There was no loss of consciousness, chest pain, or breathing difficulties. The patient was observed in the hospital until stable and referred for follow-up in the hand clinic at 4 weeks. An electromyelogram (EMG) was scheduled. Clinical examination revealed weakness of deltoid, supraspinatus, infraspinatus, teres minor, biceps, brachialis, brachioradialis, and extensor carpi radialis longus. The remainder of his forearm musculature was preserved and he could grasp, release, and pinch. Sensations were decreased along the distribution of the axillary nerve. There was 3-cm wasting of his arm and 2 cm of the forearm. Tinelâs sign is positive around the clavicle. Hornerâs signs are absent and his arm lies against the body. The EMG report showed fibrillation potentials in the weak muscles. The patient can now flex his elbow. When asked to demonstrate, he flexes his wrist and pronates his forearm to swing his elbow into flexion.

The most important function that needs to be restored in this patient is:

1) Shoulder abduction
3) Elbow flexion
2) Shoulder elevation
5) Elbow extension
4) Wrist extension

Elbow flexion is central to management of brachial plexus management because it serves the most important function of feeding.

Correct Answer: Elbow flexion

1510. (2363) Q4-2821:

An 18-month-old boy presents with a clawing deformity of the right hand. He was born full term after a difficult delivery complicated by shoulder dystocia. He weighed 9.5 lbs at birth. The patient had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the neonatal intensive care unit. A tender bump was noted on the patientâs right clavicle, which was diagnosed as clavicle fracture. A week later, the patient could not flex the fingers of his right hand. The neonatologist informed the parents that the fracture was managed conservatively and the absence of finger flexion was due to fracture and would recover. However, recovery can be prolonged and may take up to two years. The patient has grown and his immunization is complete. His right hand has extension at all the metacarpal joints of the fingers while the proximal interphalangeal and distal interphalangeal joints are flexed. The thumb is in an adducted position, and it is difficult to passively bring the thumb to full abduction. There is obvious wasting of the hand and forearm. The patient moves the arm well with no abnormalities noticed at the shoulder, elbow, and wrist. Radiograph of the chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Hornerâs syndrome and the grasp reflex is absent.

Diagnosis of this condition is:

1) Erbâs palsy
3) Cerebrovascular accident
2) Klumpkeâs palsy
5) Syringomyelia
4) Ulnar and median combined nerve injury

This is a case of obstetric brachial plexus injury involving the C8, T1 roots (Klumpkeâs palsy). Erbâs palsy involves upper roots only. Combined nerve injuries can present in a similar fashion, however low ulnar and median nerve lesions will not have weakness of the flexor digitorum profundus and flexor digitorum sublimis.

History of a large baby, shoulder dystocia, and clavicle fracture point to difficult labor. The most common type of brachial plexus injury related to birth is Erbâs palsy, which is usually associated with a breech presentation. Isolated Klumpkeâs palsy is quite rare and the involvement of C8 and T1 usually occurs as part of global plexus injury.

Correct Answer: Klumpkeâs palsy

1511. (2364) Q4-2822:

An 18-month-old boy presents with a clawing deformity of the right hand. He was born full term after a difficult delivery complicated by shoulder dystocia. He weighed 9.5 lbs at birth. The patient had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the neonatal intensive care unit. A tender bump was noted on the patientâs right clavicle, which was diagnosed as clavicle fracture. A week later, the patient could not flex the fingers of his right hand. The neonatologist informed the parents that the fracture was managed conservatively and the absence of finger flexion was due to fracture and would recover. However, recovery can be prolonged and may take up to two years. The patient has grown and his immunization is complete. His right hand has extension at all the metacarpal joints of the fingers while the proximal interphalangeal and distal interphalangeal joints are flexed. The thumb is in an adducted position, and it is difficult to passively bring the thumb to full abduction. There is obvious wasting of the hand and forearm. The patient moves the arm well with no abnormalities noticed at the shoulder, elbow, and wrist. Radiograph of the chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Hornerâs syndrome and the grasp reflex is absent.

The level of the lesion in this patient is:

1) Preganglionic lesion
3) Lateral cord
2) Postganglionic lesion
5) Upper trunk
4) Posterior cord

It is difficult to clinically differentiate between a pre- and postganglionic lesion of C8, T1 in a child. Absence of Hornerâs syndrome and hemi-diaphragmatic palsy in this case indicates that this is not a preganglionic lesion. The ability of the patient to hold his head suggests that the paravertebral muscles are functional, as is true in postganglionic lesions.

Correct Answer: Postganglionic lesion

1512. (2365) Q4-2823:

An 18-month-old boy presents with a clawing deformity of the right hand. He was born full term after a difficult delivery complicated by shoulder dystocia. He weighed 9.5 lbs at birth. The patient had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the neonatal intensive care unit. A tender bump was noted on the patientâs right clavicle, which was diagnosed as clavicle fracture. A week later, the patient could not flex the fingers of his right hand. The neonatologist informed the parents that the fracture was managed conservatively and the absence of finger flexion was due to fracture and would recover. However, recovery can be prolonged and may take up to two years. The patient has grown and his immunization is complete. His right hand has extension at all the metacarpal joints of the fingers while the proximal interphalangeal and distal interphalangeal joints are flexed. The thumb is in an adducted position, and it is difficult to passively bring the thumb to full abduction. There is obvious wasting of the hand and forearm. The patient moves the arm well with no abnormalities noticed at the shoulder, elbow, and wrist. Radiograph of the chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Hornerâs syndrome and the grasp reflex is absent.

Appropriate surgical management in this case is:

1) Neurotization
3) Tendon transfers
2) Exploration and nerve grafting
5) Vascularized nerve grafting
4) Neurolysis

Neurotization is done for preganglionic lesions and has not been shown to produce successful results for lower root involvement. At 18 months, exploration and nerve grafting must be carried out. Neurolysis is reserved for cases in which recovery is partial or plateaus. Tendon transfers in children less than 3 years old do not work as well. Younger children do not cooperate well in rehabilitation. It is also difficult to decide upon the functioning motors for transfer.

Correct Answer: Exploration and nerve grafting

1513. (2366) Q4-2825:

An 18-month-old boy presents with a clawing deformity of the right hand. He was born full term after a difficult delivery complicated by shoulder dystocia. He weighed 9.5 lbs at birth. The patient had a brief episode of apnea with an APGAR score of 5 at birth and needed resuscitation and admission to the neonatal intensive care unit. A tender bump was noted on the patientâs right clavicle, which was diagnosed as clavicle fracture. A week later, the patient could not flex the fingers of his right hand. The neonatologist informed the parents that the fracture was managed conservatively and the absence of finger flexion was due to fracture and would recover. However, recovery can be prolonged and may take up to two years. The patient has grown and his immunization is complete. His right hand has extension at all the metacarpal joints of the fingers while the proximal interphalangeal and distal interphalangeal joints are flexed. The thumb is in an adducted position, and it is difficult to passively bring the thumb to full abduction. There is obvious wasting of the hand and forearm. The patient moves the arm well with no abnormalities noticed at the shoulder, elbow, and wrist. Radiograph of the chest shows a healed clavicle fracture with no evidence of diaphragmatic paralysis. There is no evidence of Hornerâs syndrome and the grasp reflex is absent.

Reconstructive surgery includes all of the following except:

1) Thumb opposition
3) Thumb adduction
2) Widening of first web space
5) Thumb capsulodesis
4) Thumb metaphalangeal (MP) fusion

This patient has developed contractures of first web space, which will not respond to passive stretching. Fusion of the MP joint is unneccesary, as tendon transfers will provide lateral and tip pinch as well as opposition.

Correct Answer: Thumb metaphalangeal (MP) fusion

1514. (2367) Q4-2826:

Which mechanism and long-term deformity is most often associated with a dorsal avulsion fracture at the base of the middle phalanx:

1) Volar proximal interphalangeal (PIP) joint dislocation and swan-neck deformity
3) Volar PIP joint dislocation and boutonniere deformity
2) Dorsal PIP joint dislocation and swan-neck deformity
5) Dorsal PIP joint dislocation and mallet finger deformity
4) Dorsal PIP joint dislocation and boutonniere deformity

Three types of PIP joint dislocations are identified: volar, dorsal, and central depression. Volar PIP joint dislocations result in avulsion of the dorsal fragment of the base of the middle phalanx, which represents the central tendonâs attachment. If displacement persists, than a boutonniere deformity may result. Volar avulsion fractures of the PIP joint are often due to a hyperextension injury at the attachment of the volar plate.Correct Answer: Volar PIP joint dislocation and boutonniere deformity

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1515. (2368) Q4-2827:

At what degree of flexion is ulnar collateral ligament injury tested:

1) 0Âº of metacarpophalangeal (MCP) joint flexion
3) 60Âº of MCP joint flexion
2) 30Âº of MCP joint flexion
5) 120Âº of MCP joint flexion
4) 90Âº of MCP joint flexion

At 30Âº of MCP joint flexion, the ulnar collateral ligament is isolated from the volar plate.Correct Answer: 30Âº of MCP joint flexion

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1516. (2369) Q4-2828:

Which of the following structures are found within the first dorsal compartment:

1) Abductor pollicis longus and extensor indicis
3) Abductor pollicis longus and extensor pollicis brevis
2) Abductor pollicis longus and extensor pollicis longus
5) Extensor carpi radialis longus and extensor pollicis brevis
4) Abductor pollicis brevis and extensor pollicis longus

The first dorsal compartment encompasses the abductor pollicis longus and extensor pollicis brevis. Multiple slips of abductor pollicus brevis may be present, which is important in de Quervainâs release.Correct Answer: Abductor pollicis longus and extensor pollicis brevis

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1517. (2370) Q4-2829:

A 28-year-old man fell off his bike and sustained a fall onto his outstretched hand. He experiences thumb and index finger numbness. Attempts at reduction of his grade I open extra-articular distal radius fracture are unsuccessful. The next appropriate step of management is:

1) Incision and drainage, splint in functional position, and bone grafting
3) Incision and drainage, open reduction with internal fixation
2) Incision and drainage, carpal tunnel release, and splint in functional position
5) Incision and drainage, open reduction with internal fixation, carpal tunnel release, and bone grafting
4) Incision and drainage, open reduction with internal fixation, and carpal tunnel release

A patient with this injury represents a high-energy fracture in a high demand individual. The patient will require incision and drainage of his open wound, open reduction with internal fixation, and carpal tunnel release. Bone grafting would not be appropriate in a patient with open fracture.Correct Answer: Incision and drainage, open reduction with internal fixation, and carpal tunnel release

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1518. (2371) Q4-2830:

Which of the following is not usually associated with radial deficiency:

1) Thrombocytopenia absent radii
3) Holt-Oram syndrome
2) Fanconi anemia
5) Cardiac anomalies
4) Larsen syndrome

Patients with thrombocytopenia absent radii, Fanconi anemia, Holt-Oram syndrome, and cardiac anomolies all are associated with radial deficiency. Larsen syndrome is associated with multiple, larger joint dislocation.Correct Answer: Larsen syndrome

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1519. (2372) Q4-2831:

Which of the following is the most common carpal coalition in the hand:

1) Lunotriquetral
3) Capitohamate
2) Scapholunate
5) Capitolunate
4) Radioscaphoid

Lunotriquetral coalition has a 1.6% prevalence in the general population. The second most common coalition is the capitohamate. Incomplete coalition is treated by arthrodesis of the lunotriquetral joint.Correct Answer: Lunotriquetral

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1520. (2373) Q4-2832:

A 6-year-old boy presents with a Salter-Harris II distal radius fracture 3 weeks after injury. He is nontender and neurologically intact. On radiographs, he has a 35Âº dorsal angulation. The appropriate course of treatment is:

1) Observe, cast, follow until healed
3) Close reduction and casting
2) Observe, cast, follow with serial radiographs for at least 2 years
5) Open reduction
4) Close reduction and pins

For a patient with delayed presentation of a distal radius fracture, appropriate management includes casting and observation for at least 2 years to assess physeal damage and remodeling. The patient may require osteotomy if remodeling does not occur.Correct Answer: Observe, cast, follow with serial radiographs for at least 2 years

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1521. (2374) Q4-2833:

The oblique retinacular ligament connects with what two structures:

1) Flexor tendon to lateral extensor tendon
3) Flexor tendon sheath to lateral extensor tendon
2) Flexor tendon to central slip
5) Flexor tendon sheath to head of middle phalanx
4) Flexor tendon sheath to central slip

Landsmeer (oblique retinacular ligament) runs from the flexor tendon sheath of the proximal phalanx to the lateral extensor tendon as they insert onto the base of the proximal phalanx. A stay or retaining ligament maintains centralization of the extensor tendons.Correct Answer: Flexor tendon sheath to lateral extensor tendon

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1522. (2375) Q4-2834:

A patient presents with hand weakness. On examination, she has no sensory deficient, decreased strength with pronation, and her elbow is at 90Âº of flexion and pulp-to-pulp contact on key pinch. The most likely diagnosis is:

1) Carpal tunnel syndrome
3) Posterior interosseous nerve syndrome
2) Anterior interosseous nerve syndrome
5) Martin-Gruber connection
4) Cubital tunnel syndrome

Anterior interosseous nerve syndrome is due to compression of the anterior interosseous nerve (AIN) in the forearm by lacterus fibrosis, flexor digitorum superficialis, or pronator teres. The AIN innervates the pronator quadratus, flexor digitorum profundus (FDP) to the index finger and the flexor pollicis longus (FPL). Anatomy variation exists where the AIN may innervate part of the flexor digitorum superficialis. In this patient, she has decreased pronation at 90Âº flexion, which relaxes the humeral attachment of the pronator from the pronator quadrus weakness. She also has pulp-to-pulp contract due to weakness of the FPL and FDP to the index finger.Correct Answer: Anterior interosseous nerve syndrome

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1523. (2376) Q4-2835:

Indications for operative treatment in an acute elbow dislocation include:

1) Instability to valgus stress
3) Radial head fracture involving 30% of the radial head
2) Recurrent dislocation with extension past 50Âº
5) Ulnar nerve parathesias
4) Osteochondral lesions

Recurrent dislocations with extension past 50Â° represent a significant injury to the elbow and require a stabilization period. Instability to valgus stress represents injury to the anterior band of the medial collateral ligament of the elbow and will heal with protected motion. The majority of radial head fractures (Mason type I and II) that are less than 30Âº of the radial head and less than 30Âº angulation heal with good functional results. Most dislocations will have osteochondral lesions. Ulnar nerve parathesias can be associated with dislocations but is not an indication for operative fixation.Correct Answer: Recurrent dislocation with extension past 50Âº

1524. (2377) Q4-2836:

When performing open reduction and internal fixation of radial neck fractures, the plate should be placed:

1) In the "nonarticular safe-zone" comprising 120Âº of the 360Âº radial head circumference
3) Forearm in supination with plate anterior
2) Forearm in pronation with plate posterior
5) Forearm in neutral with plate anterior
4) Forearm in supination with plate posterior

The "nonarticular safe-zone" comprising only 90Âº of the radial head circumference is achieved by placing the plate posterior with the arm in supination.Correct Answer: Forearm in supination with plate posterior

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1525. (2378) Q4-2837:

Heterotopic ossification after elbow dislocations is not associated with which of the following:

1) Delay surgical intervention
3) Aggressive passive range of motion after dislocation
2) Closed head injury
5) Concomitant proximal humeral fracture
4) Extensive surgical dissection

Heterotopic ossification is commonly associated with delay of surgical intervention, closed head injury, aggressive passive range of motion after dislocation, and extensive surgical dissection. Radiographic evidence of heterotopic ossification is present in 75% of patients with elbow dislocations but only 5% of these are clinically significant.Correct Answer: Concomitant proximal humeral fracture

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1526. (2379) Q4-2838:

What is the order of joint destruction in a patient with scapholunate disassociation:

1) Radial styloid, proximal radioscaphoid, radiolunate, midcarpal
3) Proximal radioscaphoid, midcarpal, radiolunate
2) Radial styloid, proximal radioscaphoid, radiolunate
5) Radial styloid, proximal radioscaphoid, midcarpal
4) Proximal radioscaphoid, radial styloid, midcarpal, radiolunate

Patients with scapholunate disassociation can develop a scapholunate advanced collapsed wrist. The progression is from the radial styloid to proximal radioscaphoid, to midcarpal (capitolunate). The lunate is extended and unloaded due to its concentric design, which results in preservation of the radiolunate.Correct Answer: Radial styloid, proximal radioscaphoid, midcarpal

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1527. (2380) Q4-2839:

Which of the following is not characteristic of Dupuytrenâs disease:

1) Autosomal dominant trait
3) Higher prevalence in men
2) Irish and Scottish decent
5) Predictable progression of disease
4) Ring and small finger involvement first

Dupuytrenâs disease is characteristically unpredictable in its clinical progression. It may spontaneously resolve or quickly progress to advanced disease.Correct Answer: Predictable progression of disease

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1528. (2381) Q4-2840:

Operative indications for Dupuytrenâs contracture include:

1) Metacarpophalangeal joint contraction of more than 25Âº to 30Âº
3) Palpable cords in the palm
2) Proximal interphalangeal joint contracture of 30Âº or more
5) Painful palmar nodule
4) Decreased light touch sensation to affected digits

As a general guideline the "table test" is used as an indication for operative intervention. If the patient cannot lay his/her hand flat onto a table, the disease has usually progressed to the point where surgery is required. A metacarpophalangeal joint contracture of 30Âº to 40Âº or a proximal interphalangeal joint contracture of 30Âº or more is an indication for surgery.Correct Answer: Proximal interphalangeal joint contracture of 30Âº or more

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1529. (2382) Q4-2841:

Favorable indications for attempted replantation include:

1) Amputation of the thumb
3) Crush injuries to the distal forearm
2) Warm ischemia time of less than 16 hours
5) Sharp amputation proximal to the elbow
4) Cold ischemia time of less than 20 hours

Favorable indications for replantation include thumb amputations because of the functional importance of the thumb. Warm ischemias less than 8 hours or cold ischemia time less than 16 hours are more favorable for replantation.Correct Answer: Amputation of the thumb

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1530. (2383) Q4-2842:

Injuries to the central articular disk portion of the triangular fibrocartilage complex are related to all of the following except:

1) Age
3) Ulnocarpal impingement
2) Positive ulnar variance
5) Avulsion injuries from the dorsal ligamentous attachments
4) Scaphoid nonunion

Scaphoid nonunion is not related to central triangular fibrocartilage complex injuries. A positive ulnar variance is most strongly associated with triangular fibrocartilage complex central disk injuries.Correct Answer: Scaphoid nonunion

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1531. (2384) Q4-2843:

A patient reports that he felt a pop and immediate pain over the MP joint of his finger. Examination reveals tenderness on the dorsum of the joint and subluxation of the extensor tendon. Which of the following is the most common defect:

1) Central slip
3) Triangular ligament
2) Lateral bands
5) Extensor tendon
4) Sagittal fibers

Tears of the sagittal fibers of the dorsal aponeurosis result in subluxation of the extensor tendon. This usually occurs on the long finger with subluxation to the ulnar side. Treatment for acute injuries requires immobilization of the metacarpophalangeal joint in extension for 6 weeks. Treatment for chronic injuries includes repair of the torn radial sagittal fibers.Correct Answer: Sagittal fibers

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1532. (2385) Q4-2844:

All of the following transfers may be used to improve function in a patient who has had radial nerve paralysis longer than 6 months, except:

1) Pronator to extensor carpi radialis brevis
3) Flexor digitorum superficialis of the ring finger to digital extensors
2) Flexor carpi radialis extensors
5) Flexor palmaris longus to extensor pollicis longus
4) Flexor digitorum superficialis of the ring finger to brachioradialis

Radial nerve paralysis is a common injury, and many patients recover after repair. Tendon transfers should be delayed until sufficient time for reinnervation has passed. Pronator to extensor carpi radialis brevis can be performed at time of nerve repair to provide wrist extension and grasp during period of nerve recovery. Transfers for radial nerve palsy need to address wrist extension, thumb extension, and finger extenstion. All of the above transfer would provide these functions except a transfer to the brachioradialis.Correct Answer: Flexor digitorum superficialis of the ring finger to brachioradialis

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1533. (2386) Q4-2845:

Slide 1

A 24-year-old man presents with a short forearm and a hand deformity. The patient is otherwise healthy with no other congenital defects. The clinical appearance of his forearm is shown (Slide). Your diagnosis is:

1) Ulnar club hand
3) Postaxial longitudinal deficiency
2) Preaxial longitudinal deficiency
5) Hypoplastic hand syndrome
4) Thumb aplasia

This is a classic appearance of a radial club hand, which is often referred to as preaxial longitudinal deficiency. Ulnar club hand and postaxial longitudinal deficiency are synonymous.Correct Answer: Preaxial longitudinal deficiency

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1534. (2387) Q4-2846:

Slide 1

A 24-year-old man presents with a short forearm and a hand deformity. The patient is otherwise healthy with no other congenital defects. The clinical appearance of his forearm is shown (Slide). The patient has an elbow flexion contracture of 70Â° and desires lengthening. Which of the following statements is not true regarding lengthening:

1) Nerve palsies may occur during lengthening.
3) Lengthening usually equalizes limb length.
2) Lengthening must be done gradually.
5) Lengthening leads to recurrence of the deformity.
4) Lengthening helps improve function by extending the reach.

In most cases of radial club hand, excluding a hypoplastic radius, full correction cannot be achieved.Correct Answer: Lengthening usually equalizes limb length.

1535. (2388) Q4-2847:

Slide 1

A 24-year-old man presents with a short forearm and a hand deformity. The patient is otherwise healthy with no other congenital defects. The clinical appearance of his forearm is shown (Slide). The potential complications of lengthening are discussed, and the patient is advised against it. However, the elbow flexion contracture is corrected by gradual distraction. One year postoperatively, the patient has attained a 30Â° correction of the flexion deformity, which remains mobile. Now, he desires that his wrist deformity be corrected. The procedure of choice is:

1) Arthrodesis
3) Centralization
2) Radialization
5) Tendon transfers
4) Proximal row carpectomy

Wrist arthrodesis is the best solution for this patient and his recurrent deformity because it provides a stable platform for grasp.Correct Answer: Arthrodesis

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1536. (2389) Q4-2848:

Slide 1

A 24-year-old man presents with a short forearm and a hand deformity. The patient is otherwise healthy with no other congenital defects. The clinical appearance of his forearm is shown (Slide). Although the patient has a thumb, it is in an abnormal position. Any attempt to make his thumb more functional will be influenced by:

1) Index finger camptodactyly
3) Stiff fingers
2) Presence of a side-to-side finger grip
5) Radial bowing
4) Recurrence of radial club hand

The pattern of usage of the hand is established in the brain by 2 to 3 years of age. Although pollicization has been performed in adolescents, patients continue to prefer a scissor pinch. At 24 years of age, this pattern will be well established. The patient can be coaxed to use his thumb, but it will not be involuntary and automatic.Correct Answer: Presence of a side-to-side finger grip

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1537. (2390) Q4-2849:

Slide 1

A radial club hand is the result of an insult during which phase of the gestation period:

1) Weeks 1 to 4
3) Weeks 8 to 12
2) Weeks 4 to 7
5) Anytime during gestation
4) Weeks 12 to 16

A radial club hand is the result of an insult during weeks 4 to 7 of gestation.Correct Answer: Weeks 4 to 7

1538. (2391) Q4-2850:

A 15-day-old boy presents with deformity of the right hand. The boy was delivered prematurely and underwent an urgent arterial switch for transposition of great vessels. The patient is in stable condition. He has a radial club hand, and because the radial head cannot be palpated, total absence of radius is suspected. The thumb is absent and the index finger has camptodactyly. The forearm is short compared to the left side, and the patient flexes his elbow upon stimulation. Spontaneous finger motion is also present. A thorough physical examination is performed and a set of investigations is ordered. The results are as follows: complete blood count 10,000 mcu/L; platelet 254 254×10^3 mcu/L; neutophils 50%; Hb 14.2 mg/dL; lymphocytes 40%; Hct 45; and monocytes 10%. No renal abnormalities were noted on ultrasonogram of the abdomen. A radiograph of the spine is normal.

Diagnosis is:

1) Vertebral defects, anal atresia, tracheoesophageal fistula with esophageal atresia, and radial and renal anomalies (VATER)
3) Thrombocytopenia absent radii (TAR) syndrome
2) Abnormalities of vertebrae, anus, cardiovascular tree, trachea, esophagus, renal system, and limb buds (VACTERL)
5) Fanconiâs anemia
4) Holt-Oram syndrome

The patient has a radial club hand with a cardiac defect. Because the spine radiograph is normal, the diagnosis cannot be VATER or VACTERL anomaly as both involve vertebrae. Blood work up is normal, making this diagnosis Holt-Oram syndrome.Correct Answer: Holt-Oram syndrome

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1539. (2392) Q4-2851:

The principal abnormality associated with Holt-Oram syndrome is:

1) Platelet deficiency
3) Pancytopenia
2) Cardiac defects
5) Vertebral defects
4) Malignancy

Holt-Oram syndrome is associated with cardiac defects. The most common defect is aldosterone secretion.Correct Answer: Cardiac defects

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1540. (2393) Q4-2852:

The hereditary pattern for Holt-Oram syndrome is:

1) Autosomal recessive
3) Sex-linked recessive
2) Autosomal dominant
5) Sporadic
4) Sex-linked dominant

Holt-Oram syndrome is inherited in an autosomal dominant manner.Correct Answer: Autosomal dominant

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1541. (2394) Q4-2853:

A 15-day-old boy presents with deformity of the right hand. The boy was delivered prematurely and underwent an urgent arterial switch for transposition of great vessels. The patient is in stable condition. He has a radial club hand, and because the radial head cannot be palpated, total absence of radius is suspected. The thumb is absent and the index finger has camptodactyly. The forearm is short compared to the left side, and the patient flexes his elbow upon stimulation. Spontaneous finger motion is also present. A thorough physical examination is performed and a set of investigations is ordered. The results are as follows: complete blood count 10,000 mcu/L; 254×10^3 mcu/L; neutophils 50%; Hb 14.2 mg/dL; lymphocytes 40%; Hct 45; and monocytes 10%. No renal abnormalities were noted on ultrasonogram of the abdomen. A radiograph of the spine is normal.

The next step in the management of the radial club hand is:

1) Stretching
3) Radialization
2) Soft-tissue distraction
5) Pollicization
4) Centralization

For the first 6 to 9 months, parents and therapists perform passive stretching. Serial casting and splinting may also be used. Sometimes, preoperative soft-tissue distraction is performed, usually before a wrist stabilization procedure.Correct Answer: Stretching

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1542. (2395) Q4-2854:

A 15-day-old boy presents with deformity of the right hand. The boy was delivered prematurely and underwent an urgent arterial switch for transposition of great vessels. The patient is in stable condition. He has a radial club hand, and because the radial head cannot be palpated, total absence of radius is suspected. The thumb is absent and the index finger has camptodactyly. The forearm is short compared to the left side, and the patient flexes his elbow upon stimulation. Spontaneous finger motion is also present. A thorough physical examination is performed and a set of investigations is ordered. The results are as follows: complete blood count 10,000 mcu/L; platelet 254×10^3 mcu/L; neutophils 50%; Hb 14.2 mg/dL; lymphocytes 40%; Hct 45; and monocytes 10%. No renal abnormalities were noted on ultrasonogram of the abdomen. A radiograph of the spine is normal.

Centralization will be performed on the patient. All of the following statements are true about centralization except:

1) It is necessary to make a notch in the carpus when performing centralization.
3) Preoperative soft tissue distraction can be useful.
2) The forearm must be aligned with the second metacarpal.
5) Ulnocarpal fusion is a known outcome.
4) Transfer of tendons from the radial to ulnar side provides additional stability.

In a centralization procedure, the forearm is aligned with the third metacarpal, not the second.Correct Answer: The forearm must be aligned with the second metacarpal.

1543. (2396) Q4-2855:

A 15-day-old boy presents with deformity of the right hand. The boy was delivered prematurely and underwent an urgent arterial switch for transposition of great vessels. The patient is in stable condition. He has a radial club hand, and because the radial head cannot be palpated, total absence of radius is suspected. The thumb is absent and the index finger has camptodactyly. The forearm is short compared to the left side, and the patient flexes his elbow upon stimulation. Spontaneous finger motion is also present. A thorough physical examination is performed and a set of investigations is ordered. The results are as follows: complete blood count 10,000 mcu/L; 254Ã10^3 mcu/L; neutophils 50%; Hb 14.2 mg/dL; lymphocytes 40%; Hct 45; and monocytes 10%. No renal abnormalities were noted on ultrasonogram of the abdomen. A radiograph of the spine is normal.

When the patient is 10 years old, he is not satisfied with the length of his forearm and wishes to lengthen it. Which of the following is not a satisfactory recommendation:

1) Acute lengthening with bone graft
3) Hybrid frame and distraction using the Ilizarov method
2) Circular ring fixator and gradual distraction
5) Lengthening
4) External frame and distraction using De Bastianiâs principles

Acute lengthening is done for small defects and, if performed in this patient, may result in severe neurovascular compromise.Correct Answer: Acute lengthening with bone graft

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1544. (2397) Q4-2856:

Which of the following conditions is present in patients with radial club hand but not in patients with ulnar club hand:

1) Thumb hypoplasia
3) Short forearm
2) Thumb aplasia
5) Bowing of the forearm
4) Renal malformations

Ulnar club hand differs from radial club hand in that cardiopulmonary, hematopoeitic, gastrointestinal, and genitourinary anomalies are uncommon.

Correct Answer: Renal malformations

1545. (2398) Q4-2857:

All of the following developmental anomalies are associated with ulnar club hand except:

1) Atrial septal defects
3) Fibular agenesis
2) Proximal focal femoral deficiencies
5) Radial ray defects
4) Mental retardation

Atrial septal defects are developmental abnormalities present in patients with radial club hand or Holt-Oram syndrome.

Correct Answer: Atrial septal defects

1546. (2399) Q4-2858:

Which of the following syndromes is associated with ulnar club hand:

1) Vertebral defects, anal atresia, tracheoesophageal fistula with esophageal atresia, and radial and renal anomalies (VATER)
3) Holt-Oram syndrome
2) Abnormalities of vertebrae, anus, cardiovascular tree, trachea, esophagus, renal system, and limb buds (VACTERL)
5) Femur-fibular-ulnar syndrome
4) Thrombocytopenia absent radii (TAR) syndrome

VATER, VACTERL, Holt-Oram syndrome, and TAR syndrome are associated with radial club hand. Femur-fibular-ulnar syndrome is characterized by proximal femoral focal deficiency, fibular agenesis, and ulnar ray defects.

Correct Answer: Femur-fibular-ulnar syndrome

1547. (2400) Q4-2859:

Which of the following areas is not involved in ulnar club hand:

1) Thumb
3) Shoulder
2) Elbow
5) Vertebra
4) Femur

Vertebrae are usually not involved in ulnar club hand.

Correct Answer: Vertebra

1548. (2401) Q4-2860:

All of the following are true statements regarding elbow involvement in ulnar club hand except:

1) Fifty percent of patients have radial head dislocation.
3) Elbow instability worsens with the severity on involvement.
2) Nearly 50% of aplasia patients have radiohumeral synostosis.
5) The elbow is usually normal in all hypoplastic patients.
4) The anlage causes radial head dislocation or subluxation.

Elbow instability does not correspond with severity of involvement. Fifty percent of patients with total aplasia have radiohumeral synostosis, which provides adequate stability.

Correct Answer: Elbow instability worsens with the severity on involvement.

1549. (2402) Q4-2861:

All of the following statements are true regarding the carpal bones in patients with ulnar club hand except:

1) Involvement of carpus is severe in type III.
3) Carpal coalition is present in approximately 25% of patients.
2) The pisiform is the most common missing carpus.
5) The extent of ulnar deformity does not correlate with deformities in the hand.
4) Making a notch in the carpus provides stability at the wrist joint.

A notch is often created in centralization procedures for radial club hand. Wrist stabilization procedures are not performed for ulnar club hand.

Correct Answer: Making a notch in the carpus provides stability at the wrist joint.

1550. (2403) Q4-2862:

All of the following anomalies are present in patients with ulnar club hand except:

1) Phocomelia
3) Humeral aplasia
2) Transverse arrest
5) Vertebral dysplasia
4) Humeral hypoplasia

Vertebral anomalies are not common in patients with ulnar club hand.

Correct Answer: Vertebral dysplasia

1551. (2404) Q4-2863:

Slide 1

A 1-year-old boy was born full-term and pregnancy was uneventful. However, the parents noticed deformity of the patientâs forearm, which progressed with growth. The parents consulted a pediatric orthopaedic surgeon 4 months prior and were advised to observe the growth. Multiple investigations in the form of two-dimensional echogram, abdomen ultrasonography, radiographs of the spine, and complete blood work did not reveal any abnormalities. No genetic or syndromic abnormality was reported. A radiograph taken 4 months prior is shown.

1) Postaxial longitudinal deficiency
3) Ulnar agenesis
2) Preaxial longitudinal deficiency
5) Cleft hand
4) Radial club hand

The ulnar deficiency is longitudinal and the ulna is considered a postaxial bone. Ulnar agenesis means absence while radial club hand is a pre-axial longitudinal deficiency and cleft hand is a central deficiency.

Correct Answer: Postaxial longitudinal deficiency

1552. (2689) Q4-3182:

A 45-year-old man presents with marked lateral elbow pain. He says that the pain has been present for 3 weeks. He has no history of recent trauma. He is an avid tennis player, and he feels increased pain after playing tennis and when doing wrist extension exercises in the gym. His pain is maximally reproduced with resisted middle finger extension and with forearm supination with the elbow extended. Electromyography would confirm the diagnosis as:

1) Radial head fracture
3) Lateral ulnar collateral ligament tear
2) Lateral condyle fracture
5) Radial tunnel syndrome
4) Lateral epicondylitis

The clinical picture is similar to that of lateral epicondylitis. However, the maximal tenderness is slightly more distal, just beyond the radial head. Diagnosis may be confirmed using provocative maneuvers (resisted middle finger extension or forearm supination with the elbow extended) or with electromyography.Correct Answer: Radial tunnel syndrome

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1553. (2690) Q4-3183:

A 45-year-old man presents with marked lateral elbow pain. He says that the pain has been present for 3 weeks. He has no history of recent trauma. He is an avid tennis player, and he feels increased pain after playing tennis and when doing wrist extension exercises in the gym. His pain is maximally reproduced with resisted middle finger extension and with forearm supination with the elbow extended. Which of the following is the appropriate initial treatment:

1) Open reduction and internal fixation
3) Posterior interosseous nerve decompression
2) Arthroscopic ligament repair
5) Anti-inflammatory medication and a program of muscle strengthening
4) Release of the extensor carpi radialis brevis origin off the lateral epicondyle

Ninety to 95% of all patients with tennis elbow respond to nonoperative treatment, which should always be tried first. Treatment begins with a period of rest, ice, and nonsteroidal anti-inflammatory medications.Correct Answer: Anti-inflammatory medication and a program of muscle strengthening

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1554. (2691) Q4-3184:

Lateral epicondylitis is associated with a tear in the fibers of which muscle:

1) Extensor carpi radialis brevis (ECRB)
3) Brachioradialis
2) Extensor carpi radialis longus (ECRL)
5) Anconeus
4) Supinator

Current consensus is that tennis elbow is associated with a strain or microtear of the ECRB origin, which lies beneath the ECRL.Correct Answer: Extensor carpi radialis brevis (ECRB)

1555. (2692) Q4-3185:

The gold standard for diagnosis of lateral epicondylitis is considered:

1) History and physical examination
3) Electromyography
2) Plain radiographs
5) Radionuclear bone scan
4) Magnetic resonance imaging

The clinical diagnosis of lateral epicondylitis is supported by specific provocative tests. The gold standard for diagnosis is the history and physical examination. Tenderness on examination is localized to the lateral epicondyle, which can radiate into the forearm; the area of maximum tenderness is approximately 2 mm to 5 mm distal and anterior to the midpoint of the lateral epicondyle. There is usually a history of overuse or of a repetitive activity. The pain is aggravated, with the elbow extended, by resisted wrist and finger extension or with passive finger and wrist flexion.Correct Answer: History and physical examination

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1556. (4055) Q4-3186:

The amount of time that nonoperative management should be followed for lateral epicondylitis is closest to:

1) 1 day
3) 1 month
2) 1 week
5) 6 months or longer
4) 3 months

Ninety to 95% of all patients with tennis elbow respond to nonoperative treatment, and it remains the mainstay for treatment of lateral epicondylitis. Operative treatment may be indicated for debilitating pain in patients without other pathologic causes of pain for whom nonoperative treatment has failed after a reasonable length of time. This time period is usually a minimum of 6 to 12 months.Correct Answer: 6 months or longer

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1557. (2693) Q4-3187:

Extracorporeal shock wave therapy _____ in the treatment of lateral epicondylitis in high-quality trials.

1) Is ineffective
3) Has not been tested
2) Is beneficial
5) Improves function
4) Improves short-term pain

Current studies have found no benefit of extracorporeal shock wave therapy in the treatment of lateral epicondylitis.Correct Answer: Is ineffective

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1558. (2768) Q4-3266:

All of the following medications are indicated in the early treatment of frostbite injury except:

1) Ibuprofen
3) Antibiotic prophylaxis
2) Tetanus booster
5) Intravenous beta blocker
4) Narcotic pain medications

Peripheral beta-blockade has minimal effect on peripheral vasculature and is not typically used in patients with frostbite injury. Ibuprofen, tetanus booster, antibiotic prophylaxis, and appropriate pain medication are routinely used in the treatment of frostbite injuries.Correct Answer: Intravenous beta blocker

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1559. (2769) Q4-3267:

Orthopedic sequelae of frostbite injury include all of the following except:

1) Joint contractures
3) Decreased risk of future frostbite injury
2) Localized osteoporosis
5) Cold intolerance
4) Punched-out subchondral bony lesions

People who have had previous frostbite injuries are at increased risk of thermal injury, whether cold or heat related. Joint contractures, localized osteoporosis, punched-out subchondral bony lesions, and cold intolerance are often present after frostbite injury.Correct Answer: Decreased risk of future frostbite injury

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1560. (2770) Q4-3268:

Initial treatment of an acute frostbite injury should include:

1) Rapid rewarming in circulating 34Â° C to 36Â° C water
3) Rapid rewarming in steam
2) Rapid rewarming in circulating 40Â° C to 42Â° C water
5) Slow rewarming in room air
4) Slow rewarming with intermittent 50Â° C to 55Â° C water

Rapid rewarming in a 40Â° C to 42Â° C circulating water bath is the most effective early treatment of frostbite injury. Slow or fast rewarming in other temperatures and/or rewarming in air is not indicated.Correct Answer: Rapid rewarming in circulating 40Â° C to 42Â° C water

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1561. (2771) Q4-3269:

Air temperature below _____ presents a pronounced risk of frostbite injury.

1) 32Â° C
3) 0Â° C
2) 10Â° C
5) â25Â° C
4) â10Â°C

Frostbite will generally not occur above â10Â° C, but the risk is significantly increased when the air temperature is below â25Â° C.Correct Answer: â25Â° C

1562. (2772) Q4-3270:

Superficial frostbite injuries result in:

1) Minimal tissue loss
3) Firm tissue
2) Significant tissue loss
5) Hemorrhagic blisters
4) Amputation

Superficial frostbite typically involves minimal tissue loss. Patients have pliable skin with sensation. Deep frostbite typically results in significant soft tissue loss with firm anesthetic tissue that forms hemorrhagic blisters.Correct Answer: Minimal tissue loss

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1563. (2773) Q4-3271:

All of the following except _____ increase the risk of frostbite injury.

1) Altitude higher than 17,000 feet
3) Increased humidity
2) History of smoking
5) Peripheral vascular disease
4) Prolonged exposure

High altitudes, prolonged exposure, and anything that would cause peripheral vasoconstriction increase the risk of frostbite injury. Humidity does not play a significant role in the development of frostbite injury.Correct Answer: Increased humidity

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1564. (2774) Q4-3272:

Treatment for frostbite injury includes:

1) Limiting active motion of the frostbitten area
3) Stopping the rewarming process when there is pain secondary to reperfusion
2) Elevating the frostbitten extremity to reduce edema
5) Massaging the frostbitten area thoroughly to increase perfusion
4) Using dry heat

Treatment of frostbite includes rapid rewarming (even when reperfusion pain occurs), early active motion, elevation, and avoidance of dry heat that can dessicate tissues. Massaging the frostbitten area is not recommended because it may induce additional trauma via shearing forces.Correct Answer: Elevating the frostbitten extremity to reduce edema

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1565. (2947) Q4-3450:

Arthritis of the wrist is estimated to effect what percentage of the U.S. population:

1) Less than 1%
3) 5%
2) 3%
5) More than 15%
4) 10%

Arthritis of the wrist is estimated to affect 5.3% of the U.S. population, based on radiographic assessments of 4,000 wrists.[1] After having rheumatoid arthritis (RA) for 10 years, 90% of patients experience arthritis in their wrist joints.[2]

Correct Answer: 5%

1566. (2948) Q4-3451:

The accessory ulnar collateral ligament inserts on the:

1) Proper ulnar collateral ligament
3) Proximal phalanx
2) Lateral bands
5) Flexor sheath
4) Volar plate

The accessory ulnar collateral ligament inserts into the volar plate, whereas the proper collateral inserts into the base of the proximal phalanx.Correct Answer: Volar plate

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1567. (3113) Q4-3623:

Which of the following nerves is not a primary articular nerve of the wrist:

1) Posterior interosseous nerve (PIN)
3) Palmar cutaneous branch of the median nerve
2) Lateral antebrachial cutaneous nerve
4) Articular branches from the median nerve

Fukumoto and colleagues have used Wykeâs definition to explain primary and accessory innervation of the wrist. Primary articular nerves consist of small nerves that pass to each joint as independent branches of adjacent peripheral nerves. There are three primary articular nerves: the PIN, the lateral antebrachial cutaneous nerve, and the articular branches from the ulnar nerve. Accessory nerves originate from small, twig branches of intramuscular or cutaneous nerves that innervate the skin around the wrist joint. The accessory articular nerves have been identified as the anterior interosseous nerve (AIN), the palmar cutaneous branch of the median nerve, the deep and dorsal branches of the ulnar nerve, and the superficial branch of the radial nerve to the first intercarpal space.Correct Answer: Palmar cutaneous branch of the median nerve

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1568. (3114) Q4-3624:

Which of the following nerves provides principal innervation to the central dorsal portion of the wrist:

1) Anterior interosseous nerve (AIN)
3) Dorsal branch of the ulnar nerve
2) Posterior interosseous nerve (PIN)
4) Lateral antebrachial cutaneous nerve

The PIN is found on the deep radial wall of the fourth dorsal compartment, 1.2 cm ulnar to Listerâs tubercle. As the PIN approaches the radiocarpal joint, it is covered in fascia and gives one branch to the radioscaphoid joint and three to four terminal branches to the intercarpal joints. The PIN is the principal innervation to the central dorsal portion of the wrist. The AIN innervates the radial volar lip of the distal radius. The dorsal branch of the ulnar nerve contributes to innervation of the triangular fibrocartilage complex. The lateral antebrachial cutaneous nerve innervates the thumb carpometacarpal joint and the scapho-trapezotrapezoid joint.Correct Answer: Posterior interosseous nerve (PIN)

1569. (3115) Q4-3625:

What is the area of innervation of the anterior interosseous nerve (AIN):

1) Radial volar lip of the distal radius
3) Dorsal radiocarpal joint
2) Triangular fibrocartilage complex (TFCC)
4) Thumb carpometacarpal joint

The AIN is a branch of the median nerve. Its muscular innervations include the flexor pollicis longus, the radial half of the flexor digitorum profundus, and the pronator quadratus. The AIN terminates as a sensory branch to the volar radial surface of the distal radius. The TFCC is innervated by components of the ulnar nerve. The dorsal radiocarpal joint is innervated by the posterior interosseous nerve. The thumb carpometacarpal is innervated by the sensory branch of the radial nerve and the lateral antebrachial cutaneous nerve.Correct Answer: Radial volar lip of the distal radius

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1570. (3116) Q4-3626:

When performing complete wrist denervation as described by Wilhem, what pain pathology did not have predictable results:

1) Scaphoid nonunion
3) Primary radiocarpal arthritis
2) Osteonecrosis of the scaphoid
4) Ulnar carpal arthritis

In 1983, Ekerot and colleagues reported his results in 48 patients. They used the technique described by Wilhelm but only denervated the radial side of the wrist for patients with scaphoid or lunate pathology. However, the entire wrist was denervated in patients with global degenerative wrist disease or wrist pain with an unknown etiology. Pain relief occurred in only 56% of the patients. They noted the best results occurred in patients with scaphoid nonunion, osteonecrosis of the lunate, and primary radiocarpal arthritis.Correct Answer: Ulnar carpal arthritis

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1571. (3117) Q4-3627:

What two nerves are resected through a single dorsal incision for wrist denervation:

1) Superficial branch of the radial nerve and posterior interosseous nerve (PIN)
3) PIN and anterior interosseous nerve (AIN)
2) PIN and the dorsal cutaneous branch of the ulnar nerve
4) Superficial branch of the radial nerve and dorsal cutaneous branch of the ulnar nerve

Kupfer and colleagues presented a podium presentation of a single-incision approach to the resection of the PIN and AIN for denervation of the radial side of the wrist. Weinstein and Berger published their results in 2002 with a similar technique. They described a 2-cm long dorsal incision that was 3 to 5 cm proximal to the ulnar head. They then resected a 2-cm segment of the PIN and AIN. In their group of 20 patients, 85% were satisfied with their procedure after an average follow-up of 2.5 years. If failure were to occur, it occurred within the first year.Correct Answer: PIN and anterior interosseous nerve (AIN)

1572. (3118) Q4-3628:

What muscle is at risk for denervation when a single dorsal incision is used to denervate the radial side of the wrist:

1) Flexor pollicis longus
3) Flexor digitorum profundus
2) Extensor indicis
4) Pronator quadratus

The single dorsal incision approach to wrist denervation involves resection of the posterior interosseous nerve (PIN) and the anterior interosseous nerve (AIN). Distally, the PIN is purely sensory and does not give off motor branches in the vicinity of the wrist joint. The terminal portion of the AIN has both motor and sensory components. A majority of this is motor, and it innervates the pronator quadratus right up to the radiocarpal articulation. Resection of the AIN close to the radiocarpal joint has a high probability of denervating the pronator quadratus. The extensor indicis is usually the last motor branch of the PIN, but this terminal portion of this branch is more than 5 cm proximal from the distal radioulnar joint. The flexor pollicis longus is innervated by the AIN, but motor branches to this muscle are more proximal than branches to the pronator quadratus. The flexor digitorum profundus muscle is innervated by the AIN and ulnar nerve. However, the motor branches are more proximal than the incision for dorsal innervation.Correct Answer: Pronator quadratus

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1573. (3176) Q4-3995:

A 62-year-old man presents with weakness in finger extension in his right hand. He has had the weakness for 1 month but denies any significant traumatic event. The patient maintains an active lifestyle, including golf and tennis. He denies pain or numbness in his hand and is otherwise neurologically intact. Which of the following is the most likely diagnosis:

1) Thoracic outlet syndrome
3) Ulnar nerve palsy
2) Posterior interosseous nerve palsy
5) Radial nerve palsy
4) Carpal tunnel syndrome

Posterior interosseous nerve palsy is described as painless finger drop. This syndrome is commonly associated with trauma to the lateral elbow.Correct Answer: Posterior interosseous nerve palsy

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1574. (3177) Q4-3996:

Which of the following are characteristic signs of PIN palsy:

1) Weakness in finger extension
3) Elbow tenderness
2) Pain in dorsum of hand
5) Weakness in finger extension, elbow tenderness, and pain in dorsum of hand
4) Weakness in finger extension, and elbow tenderness

Painless finger drop is characteristic of posterior interosseous nerve palsy. This syndrome may also involve elbow tenderness in the absence of other clinical findings. Pain in the dorsum of the hand is not associated with this condition because the posterior interosseous nerve contains no sensory component.Correct Answer: Weakness in finger extension, and elbow tenderness

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1575. (3178) Q4-3997:

What is the most common site of posterior interosseous nerve entrapment:

1) The arcade of Frohse
3) The first cervical rib
2) The flexor retinaculum
5) Ligament of Struthers
4) In the spiral groove of the humerus

The most common site of posterior interosseous nerve entrapment is at the arcade of Frohse, which is a fibrotendinous ring found within the fibers of the supinator muscle as the posterior interosseous nerve originates from the radial nerve.Correct Answer: The arcade of Frohse

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1576. (3179) Q4-3998:

Which of the following muscles is innervated by the posterior interosseous nerve:

1) Extensor carpi ulnaris
3) Extensor pollicis brevis and longus
2) Extensor digiti minimi
5) All of the above
4) Abductor pollicis longus

The posterior interosseous nerve innervates a number of muscles involved primarily in finger extension, including the extensor carpi ulnaris, extensor digitorum, extensor digiti minimi, extensor pollicis brevis and longus, abductor pollicis longus, and extensor indices.Correct Answer: All of the above

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1577. (3180) Q4-3999:

Posterior interosseous nerve palsy affects finger extension at the metacarpophalangeal and interphalangeal joints.

1) True
2) False

Only the metacarpophalangeal joints are involved in posterior interosseous nerve palsy, as the muscles of the interphalangeal joints are innervated by the ulnar and median nerves.Correct Answer: False

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1578. (3181) Q4-4000:

A 53-year-old woman presents with bilateral hand numbness and tingling. Her right hand is more affected than her left. The numbness wakes her up at night and is relieved when she shakes her hand. In addition, the patient has had increasing difficulty with fine motor tasks, such as shirt buttoning, over the past 2 to 3 months. Upon close inspection, muscle atrophy is present at the base of her thumbs. Which of the following is the most likely diagnosis:

1) Thoracic outlet syndrome
3) Ulnar nerve palsy
2) Posterior interosseous nerve palsy
5) Radial nerve palsy
4) Carpal tunnel syndrome

This patient displays the classic signs and symptoms of bilateral carpal tunnel syndrome, which involves median nerve entrapment at the base of the palm. This entrapment leads to numbness and dysesthesias that are worse at night and upon exertion. Pain is typically relieved by shaking the hand. Furthermore, the median nerve innervates several muscles of the hands, and entrapment may lead to muscle atrophy.Correct Answer: Carpal tunnel syndrome

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1579. (3182) Q4-4001:

All of the following muscles are innervated by the median nerve except:

1) The ulnar two lumbricals (lumbricals III and IV)
3) Abductor pollicis brevis
2) Opponens pollicis
5) Flexor digitorum profundus to the middle finger
4) Flexor pollicis brevis

Lumbricals 1 and 2 are innervated by the median nerve, in addition to the opponens pollicis brevis, abductor pollicis brevis, and flexor pollicis brevis.Correct Answer: The ulnar two lumbricals (lumbricals III and IV)

1580. (3183) Q4-4002:

Carpal tunnel syndrome is typically due to median nerve entrapment at the:

1) Arcade of Frohse
3) First cervical rib
2) Flexor retinaculum
5) Ligament of Struthers
4) Spiral groove of the humerus

The carpal tunnel is made by the flexor retinaculum, also known as the transverse carpal ligament.Correct Answer: Flexor retinaculum

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1581. (3184) Q4-4003:

All of the following are true regarding the transverse carpal ligament except:

1) The transverse carpal ligament attaches medially to the pisiform and hook of hamate.
3) The palmaris longus tendon lies superficially to the transverse carpal ligament.
2) The transverse carpal ligament attaches laterally to the scaphoid and trapezium.
5) None of the above are true
4) All of the above are true

All of the above statements are true regarding the transverse carpal ligament.Correct Answer: All of the above are true

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1582. (3185) Q4-4004:

All of the following structures pass through the carpal tunnel except:

1) Motor branch of the median nerve
3) Palmar cutaneous branch of median nerve
2) Tendon of the flexor pollicis longus
5) Tendon of the flexor digitorum sublimes
4) Tendon of the flexor digitorum profundus

The palmar cutaneous branch of the median nerve originates proximally to the carpal tunnel and travels superficial to the tunnel.Correct Answer: Palmar cutaneous branch of median nerve

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1583. (3628) Q4-6515:

Dupuytrenâs contracture characteristically involves which part of the hand:

1) Ulnar side of the hand
3) Radial side of the hand
2) Thumb
5) Web space between the first and second metacarpals
4) Extensor tendons

Dupuytrenâs contracture most frequently involves the ring and small fingers. Although Dupuytrenâs cords at the thumb have been described, they are rare.Correct Answer: Ulnar side of the hand

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1584. (3629) Q4-6516:

Which of the following cells are involved in Dupuytrenâs contracture:

1) Giant cells
3) Fibrocytes
2) Polymorphonuclear cells
5) Myocytes
4) Myofibroblasts

Gabbiani and Majno noted the abnormal appearance of fibroblasts found in patients with Dupuytrenâs contracture. They used the term myofibroblasts to describe these cells because they showed characteristics of fibrous and muscular tissue.Correct Answer: Myofibroblasts

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1585. (3630) Q4-6517:

All of the following are contributory risk factors to the development of Dupuytrenâs contracture except:

1) Diabetes mellitus
3) Tobacco use
2) Hypertension
5) Human immunodeficiency virus (HIV)
4) Alcohol abuse

No association exists between high blood pressure and Dupuytrenâs disease, but all of the other listed conditions have been associated with Dupuytrenâs contracture. HIV has recently been described as a risk factor; patients with Dupuytrenâs contracture have been in advanced stages of HIV.Correct Answer: Hypertension

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1586. (3631) Q4-6518:

The use of clostridial collagenase for Dupuytrenâs contracture is performed by:

1) Injecting collagenase into the affected joint
3) Performing a subcutaneous wheal injection of collagenase
2) Injecting collagenase into the Dupuytrenâs cord
5) Applying collagenase to the Dupuytrenâs cords during surgery
4) Using a patch of collagenase on the skin

Clostridial collagenase works by breaking the collagen connections. The Dupuytrenâs cord is ruptured manually; surgery is not necessary.Correct Answer: Injecting collagenase into the Dupuytrenâs cord

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1587. (3632) Q4-6519:

Dupuytrenâs cord tissue is characterized by what change from normal:

1) An increase in type II collagen
3) An increase of type III collagen
2) A decrease in type III collagen
5) Increased hyaluronidase
4) Abnormal collagen crosslinks

Compared to normal palmar fascia, the fibrous bands in Dupuytrenâs disease have an increased ratio of type III to type I collagen, and an overall increase in the amount of type III collagen.Correct Answer: An increase of type III collagen

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1588. (3633) Q4-6520:

The strongest portion of the scapholunate interosseous ligament (SLIL) is the:

1) Proximal
3) Volar
2) Distal
5) Dorsal intercarpal
4) Dorsal

The SLIL is a c-shaped structure, which is thickest dorsally. The dorsal fibers have an average thickness of 3 mm and are composed of transversely oriented fibers, which afford the greatest resistance to translation between the scaphoid and the lunate, preventing the characteristic radiographic separation and flexion deformity of the scaphoid.Correct Answer: Dorsal

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1589. (4063) Q4-6521:

A 29-year-old man with a remote history of wrist trauma and chronic pain presents with a palpable clunk on radio-ulnar deviation of the wrist. The most sensitive technique for identifying a scapholunate injury is:

1) Plain radiographs
3) Dynamic cineradiography
2) Magnetic resonance image (MRI)
5) Arthroscopy
4) Bone scan

Magnetic resonance imaging is commonly used among patients with concern for ligamentous injuries of the wrist, particularly in the presence of an abnormal physical exam when plain radiographs are normal. However, the sensitivity of MRI has been shown to be less than 40% in comparison with arthroscopy. Arthroscopy has become the gold standard for the diagnosis of ligamentous injuries to the wrist. A classification scheme has been proposed based on both radiocarpal and midcarpal arthroscopic findings.Correct Answer: Arthroscopy

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1590. (3634) Q4-6522:

The radiographic abnormality seen on the lateral radiograph characteristic of scapholunate instability is:

1) Dorsal intercalated segment instability (DISI)
3) Terry Thomas sign
2) Volar intercalated segment instability (VISI)
5) Abnormal Gilulaâs arcs
4) Ring pole sign

On a lateral view of the wrist, when the lunate slips into a statically dorsiflexed position greater than 10Â°, the condition is defined as dorsal intercalated segmental instability (DISI). DISI deformity is also present when the scapholunate angle is greater than 60 degrees (45+/- 15 degrees is normal). The VISI deformity is seen on the lateral radiograph is characteristic of lunotriquetral dissociation. The other signs are seen on the anteroposterior projection.Correct Answer: Dorsal intercalated segment instability (DISI)

1591. (3635) Q4-6523:

A 40-year-old woman with radial sided wrist pain for the last 2 years presents to the clinic. Plain radiographs are normal. Because of continued discomfort despite conservative therapies and occasional âclickingâ of the wrist, she is taken to the operating room for diagnostic arthroscopy. At the time, fraying of the membranous portion of the scapholunate (SL) ligament is seen, with mild incongruity from the midcarpal joint. The surgeon is unable to pass a 1-mm probe through the defect. This is most consistent with:

1) Geissler Grade I SL tear
3) Geissler Grade III tear
2) Geissler Grade II SL tear
5) Scapholunate advanced collapse (SLAC) wrist
4) Geissler Grade IV tear

Arthroscopy has become the gold standard for the diagnosis of ligamentous injuries to the wrist. A classification scheme has been proposed by Geissler and colleagues, based on both radiocarpal and midcarpal arthroscopic findings (Table).

Table. Arthroscopic Classification of Interosseous Ligament Injury[11]

Grade	**Findings**
I	Attenuation of the interosseous ligament with no radiocarpal or midcarpal step-off
II	Incongruence of the scapholunate interval seen from the midcarpal joint
III	Complete separation of scaphoid and lunate visualized from both spaces; a 1-mm probe can be passed between the two bones
IV	Ability to pass 2.7-mm arthroscope between the scapholunate interval

Correct Answer: Geissler Grade II SL tear

1592. (3636) Q4-6524:

A 33-year-old woman with a history of a traumatic fall onto her wrist and tenderness over the scapholunate (SL) interval presents to the clinic. Radiographs are normal, and magnetic resonance imaging reveals a partial tear of the SL ligament. The remaining wrist ligaments are normal. If conservative therapy is attempted, then it should consist of:

1) Short arm casting for 2 months
3) Splinting and flexor carpi radialis training
2) Activity modification and wrist extension stretching
5) Corticosteroid injection into the midcarpal space
4) Splinting and flexor carpi ulnaris training

Conservative management includes a period of splinting and activity modification, followed by proprioception training of the flexor carpi radialis to act as a dynamic scaphoid stabilizer.Correct Answer: Splinting and flexor carpi radialis training

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1593. (3662) Q4-7439:

Congenital thumb duplication:

1) Should be treated after 2 years of age
3) Usually presents in association with other systemic abnormalities
2) Usually presents bilaterally
5) Occurs in approximately 1 out of every 5,000 births
4) Often presents with a hypoplastic radial thumb and a dominant-appearing ulnar thumb

Experts recommend treating congenital thumb duplication before the age of 6 months, when the potential for growth and remodeling is greatest. The condition usually presents unilaterally, lacking association with other systemic abnormalities, and usually presents with a hypoplastic radial duplicate and dominant ulnar duplicate.Correct Answer: Often presents with a hypoplastic radial thumb and a dominant-appearing ulnar thumb

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1594. (3663) Q4-7440:

Complete bifurcation of two distal phalanges articulating with a wide epiphysis of a single proximal phalanx is classified as:

1) Wassel II / IP
3) Wassel IV / MCP
2) Wassel III / IP
5) Wassel I/ Distal
4) Wassel IV / IP

Wassel II (also categorized as IP in the universal classification system) occurs when the duplication begins at the interphalangeal joint of the thumb, resulting in complete bifurcation of two distal phalanges that articulate proximally with a single proximal phalanx.Correct Answer: Wassel II / IP

1595. (3664) Q4-7441:

One of the more common complications of congenital thumb duplication reconstruction is:

1) Weakness of resulting digit
3) Ulnar deviation at metacarpophalangeal joint and radial deviation at interphalangeal joint
2) Paresthesias in resulting digit
5) Nail splitting
4) Nonhealing wound

A Z-deformity, with ulnar deviation at the MCP joint and radial deviation at the IP joint, is one of the most common complications after reconstruction. Weakness, paresthesias, and wound complications are uncommon possible complications.Correct Answer: Ulnar deviation at metacarpophalangeal joint and radial deviation at interphalangeal joint

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1596. (3850) Q4-7633:

Ultrasound therapy delivers superficial heat to the tissue and has a penetration depth of 5 mm.

1) True
2) False

Ultrasound is considered a deep heat modality and does not heat the superficial tissues.

Correct Answer: False

1597. (3851) Q4-7634:

Thermal ultrasound is used for all of the following purposes EXCEPT:

1) Increasing capsular extensibility
3) Increasing pain threshold
2) Decreasing scar
5) Increasing ligament stretch ability
4) Reversing Dupuytrenâs contracture

Thermal uses of ultrasound include increasing pain threshold, decreasing scar, and improving extensibility of the ligaments and joint capsule. Ultrasound has not been shown to have an effect in Dupuytrenâs contracture.

Correct Answer: Reversing Dupuytrenâs contracture

1598. (3852) Q4-7635:

Phonopheresis is:

1) Delivery of heat to the tissues with a special oval-shaped attachment
3) Delivery of medicine through the skin using ultrasound
2) Aspiration of blood with concentration of platelets for re-injection
5) Delivery of substimulus auditory waves to the tissue
4) Using ultrasound in a rapid, deep massage-type application

Phonopheresis is delivery of medicine through the skin using ultrasound. Although there is some question as to whether the medications are more effectively absorbed or delivered with ultrasound use, this is a described modality.

Correct Answer: Delivery of medicine through the skin using ultrasound

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1599. (3853) Q4-7636:

Iontophoresis delivers medications such as analgesics or steroids through the skin using an electrical charge.

1) True
2) False

Iontophoresis uses a direct or galvanic current to âdriveâ medications transdermally and is used for scar management and pain control.

Correct Answer: True

1600. (3854) Q4-7637:

Iontophoresis has been effectively used in all of the following EXCEPT:

1) Carpal tunnel syndrome
3) Shoulder/rotator cuff tendinitis
2) Wrist arthritis
5) Medial epicondylitis
4) Lateral epicondylitis

Iontophoresis is effective in soft tissue conditions such as rotator cuff bursitis and lateral epicondylitis.

Correct Answer: Wrist arthritis

1601. (3872) Q4-7655:

Types of nerve tissues surrounding the axons include all of the following EXCEPT:

1) Endoneurium
3) Perineurium
2) Hyponeurium
5) Epineurium
4) Mesoneurium

The structures surrounding the axons and Schwann cells include the endoneurium, perineurium, and epineurium. The mesoneurium is an adventitial layer in addition.

Correct Answer: Hyponeurium

1602. (3873) Q4-7656:

The Seddon grades of nerve injury include all of the following EXCEPT:

1) Neuropraxia
3) Neurotmesis
2) Axonotmesis
4) Schwann cell disruption

Neuropraxic injuries are stretch injuries to the nerve. Axonotmetic injury involves a more severe injury with loss of continuity of axons, and connective tissue elements remain intact. Neurotmesis is a complete nerve discontinuity. Schwann cell disruption occurs in neurotmesis but is not among the grades of Seddon nerve injury.

Correct Answer: Schwann cell disruption

1603. (3874) Q4-7657:

Younger age is associated with worse outcomes with nerve repair.

1) True
2) False

Younger age is associated with improved functional outcome after nerve repair, particularly regarding sensory recovery.

Correct Answer: False

1604. (3875) Q4-7658:

Optimum conditions for nerve healing after direct repair include:

1) Gapping at suture repair site
3) Early motion of extremity
2) Tension-free repair
5) lacing sutures through the endoneurium to increase repair strength
4) Preservation of all tissue whether devitalized or viable

Tension-free repair is the optimal technique to improve the potential for nerve recovery. Gapping, failure to splint to prevent tension on the nerve with motion, and failure to excise scarred or devitalized nerve tissue are impairments to successful nerve repairs. Suture repairs through the deep nerve segments can damage the axons. Sutures should be placed through the epineurium or, in a grouped fascicular repair, through the perineurium around the fascicles.

Correct Answer: Tension-free repair

1605. (3876) Q4-7659:

Gunshot or missile wounds can frequently cause neuropraxic injuries to peripheral nerves.

1) True
2) False

Missile wounds can cause a blast stretch injury to peripheral nerves and may recover with observation.

Correct Answer: True

1606. (3887) Q4-7766:

The anatomic location of the pathologic lesion of lateral epicondylitis is the:

1) Extensor carpi radialis longus (ECRL)
3) Extensor digitorum longus (EDL)
2) Extensor carpi radialis brevis (ECRB)
5) Annular ligament
4) Extensor digitorum communis (EDC)

While the ECRL and EDL can sometimes be involved, the primary location of most cases of tennis elbow show characteristic changes at the origin of the ECRB.

Correct Answer: Extensor carpi radialis brevis (ECRB)

1607. (3888) Q4-7767:

Which of the following injectable substances have shown benefit in the treatment of lateral epicondylitis:

1) Corticosteroids
3) Botulinum toxin
2) Autologous blood
5) All of the above
4) None of the above

All of these substances have been shown to have efficacy in the treatment of tennis elbow. However, placebo saline injections have also been proven to add some benefit compared to no treatment.

Correct Answer: All of the above

1608. (4068) Q4-7768:

The nerve most at risk during arthroscopic debridement of lateral epicondylitis is the:

1) Ulnar nerve
3) Anterior interosseous nerve
2) Median nerve
5) Musculocutaneous nerve
4) Posterior interosseous nerve

While the ulnar nerve is most at risk during elbow arthroscopy in general, debridement of the lateral capsule posterior to the midpoint of the radiocapitellar joint places the posterior interosseous branch of the radial nerve at risk.

Correct Answer: Posterior interosseous nerve

1609. (3889) Q4-7769:

Common concomitant intra-articular pathology that can be found and addressed at arthroscopy for lateral epicondylitis include all of the following, **except**:

1) Synovial plica
3) Synovitis
2) Loose body
5) Chondral lesion
4) Medial epicondylitis

While all of the other answers are intra-articular lesions that have been reported in elbow arthroscopies, medial epicondylitis is an extra-articular condition and must be addressed in an open fashion given the proximity of the ulnar nerve.

Correct Answer: Medial epicondylitis

1610. (3890) Q4-7770:

Arthroscopic resection/debridement posterior to the midline of the radio-capitellar joint can result in damage to _____ ligament, resulting in _____ instability.

1) Lateral collateral; valgus
3) Ulnar collateral; posterolateral rotatory
2) Ulnar collateral; valgus
5) Lateral collateral; posterolateral rotatory
4) Annular; posterolateral rotatory

Resection posterior to the midpoint of the radiocapitellar joint can result in damage to the lateral collateral ligament and subsequent development of posterolateral rotator instability.

Correct Answer: Lateral collateral; posterolateral rotatory

1611. (3911) Q4-7791:

The muscle that flexes the interphalangeal joint of the thumb is innervated by which roots of the brachial plexus:

1) C5, C6
3) C6, C7, C8
2) C5, C6, C7
5) C7, C8, T1
4) C5, C6, C7, C8, T1

The interphalangeal joint of the thumb is flexed secondary to actions of the flexor pollicis longus (FPL). The FPL is innervated by the anterior interosseous nerve, which is the longest branch of the median nerve. The median nerve is formed by the lateral (roots C5, C6, and C7) and medial (roots C8 and T1) cords of the brachial plexus.

Correct Answer: C5, C6, C7, C8, T1

1612. (3912) Q4-7792:

The anterior interosseous nerve (AIN) originates from the median nerve at what distance from the medial epicondyle:

1) 6 cm distal
3) 6 cm proximal
2) 10 cm proximal
5) At the medial epicondyle
4) 10 cm distal

The AIN, the largest branch of the median nerve, originates 5 cm to 8 cm distal to the medial epicondyle from the posteroradial aspect of the median nerve just distal to the proximal border of the superficial head of the pronator teres.

Correct Answer: 6 cm distal

1613. (3913) Q4-7793:

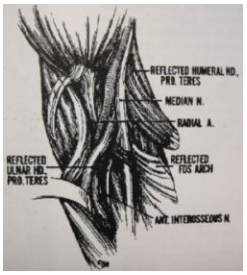
A 30-year-old right-hand dominant woman presents to the emergency department with a 6-week history of difficulty writing and pain after playing tennis. She also reports a recent inability to abduct and adduct her fingers. What is the mechanism of her symptoms:

1) Writerâs cramp or focal dystonia
3) Martin-Gruber interconnection
2) Riche-Cannieu anastamosis
5) Carpal tunnel syndrome
4) Ulnar neuropathy

Approximately 17% of the population has a Martin-Gruber interconnection, and 50% of these patients may show additional denervation of normally ulnar nerve-innervated intrinsic muscles. The Martin-Gruber anomaly is a motor neural connection between the anterior interosseous nerve and ulnar nerves that is located adjacent to the ulnar artery in the proximal forearm.

Correct Answer: Martin-Gruber interconnection

1614. (3914) Q4-7794:



What is the innervation of the indicated muscle in the image (Slide):

1) Median nerve
3) Radial nerve
2) Anterior interosseous nerve
5) Posterior interosseous nerve
4) Ulnar nerve

The arrow in the photograph (Slide) is pointing to the pronator teres â one of the most common sites for compression of the anterior interosseous nerve. The pronator teres is innervated by the median nerve.

Correct Answer: Median nerve

1615. (3915) Q4-7795:

Sites of potential compression of the median nerve include all of the following except:

1) Pronator teres
3) Pisohamate ligament
2) Transverse carpal ligament
5) Mass in carpal canal (e.g., lipoma)
4) Supracondylar process

Around the elbow, the median nerve may be compressed by the pronator teres (causing either anterior interosseous nerve syndrome or pronator syndrome) or the ligament of Struthers originating from a supracondylar process (causing pronator syndrome). In the wrist, the median nerve may be compressed by the transverse carpal ligament or a mass within the carpal canal. The ulnar nerve, not the median nerve, can be compressed by the pisohamate ligament.

Correct Answer: Pisohamate ligament

1616. (3938) Q4-8126:

What position of the wrist most commonly produces scaphoid fractures:

1) Wrist flexion and radial deviation
3) Wrist flexion and ulnar deviation
2) Wrist extension and radial deviation
5) Clenched fist and wrist flexion
4) Wrist extension and ulnar deviation

Frykman performed biomechanical studies to evaluate the wrist position in falls that produce scaphoid fractures. The results showed that wrist extension greater than 90Â° and radial deviation consistently resulted in fracture of the scaphoid.

Correct Answer: Wrist extension and radial deviation

1617. (3939) Q4-8127:

Which of the following blood vessels supplies the majority of the scaphoid:

1) Superficial palmar branch of the radial artery (volar)
3) Dorsal carpal branch of the radial artery (dorsal)
2) Radial artery
5) 3,4 intracompartmental supra-retinacular artery (3,4-ICSRA)
4) Ulnar artery

Gelberman and Menon used injection studies to demonstrate that the majority of scaphoid blood flow stems from branches of the radial artery entering the scaphoid at the distal pole. Of these, the branch entering the dorsal ridge supplies 70% to 80% of the intraosseous vascularity of the scaphoid bone. The proximal pole is completely dependent on the intraosseous blood supply and is vulnerable to avascular necrosis when fracture disrupts this vascular source.

Correct Answer: Dorsal carpal branch of the radial artery (dorsal)

1618. (3940) Q4-8128:

During a posterior (dorsal) approach to percutaneous screw fixation for a scaphoid fracture, many structures are close to the guidewire insertion location and are at risk for injury. Which of the following structures is the closest to the guidewire insertion location according to a recent cadaveric study:

1) Posterior interosseous nerve
3) Extensor indicis proprius
2) Extensor digitorum communis to the index
5) Extensor digitorum communis to the index and posterior interosseous nerve
4) Extensor carpi radialis brevis

Adamany and colleagues performed a cadaveric study to evaluate the dorsal structures at risk with truly percutaneous headless screw placement for scaphoid fractures. They noted that the posterior interosseous nerve and the extensor digitorum communis to the index finger were an average of 2.2 mm from the guidewire and therefore at greatest risk from this approach.

Correct Answer: Extensor digitorum communis to the index and posterior interosseous nerve

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1619. (3941) Q4-8129:

Which of the following is a concerning risk factor for a dorsal open approach to the scaphoid:

1) Damage to tenous blood supply of the scaphoid
3) Damage to scapho-trapezial-trapezoid joint during the approach
2) Difficulty of central screw placement
5) njury to the higher rate of infection
4) Damage to the lunatotriquetral (LT) ligament

The dorsal approach is advantageous in obtaining central screw placement. The scapho-trapezial-trapezoid joint is at risk during a volar approach, not a dorsal approach, and infection has not been shown to occur more frequently in one approach over the other. The LT ligament is not seen in either approach. The risk of the open dorsal approach is compromise of the main blood supply to the scaphoid, entering through the dorsal ridge.

Correct Answer: Damage to tenous blood supply of the scaphoid

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1620. (3942) Q4-8130:

A volar approach to the scaphoid is ideal in which of the following fractures:

1) Proximal pole fractures
3) Comminuted scaphoid fractures
2) Distal pole fractures
5) Scaphoid fracture with associated scapholunate ligament tear
4) Avascular necrosis of the scaphoid proximal pole

The volar approach to the scaphoid is optimal in distal pole fractures because it allows direct visualization of the fracture line and exact reduction and fixation. A volar approach is not recommended for fractures or avascular necrosis of the proximal pole, where dorsal screw placement is best. Scapholunate ligament tears are generally repaired from a dorsal approach because the ligament is stoutest dorsally.

Correct Answer: Distal pole fractures

1621. (3944) Q4-8195:

Which finger is most commonly involved in a flexor digitorum profundus (FDP) avulsion injury:

1) Index
3) Ring
2) Middle
5) Thumb
4) Small

An FDP avulsion is caused by forceful extension of the distal interphalangeal (DIP) joint, occurring at the same time as a maximum contraction of the FDP tendon. Jersey finger is often seen in athletes, especially football or rugby players, who commonly get their fingers caught in an opposing playerâs jersey, thus the name. In most cases, this injury affects the ring finger.Correct Answer: Ring

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1622. (3945) Q4-8196:

Which type of flexor digitorum profundus (FDP) avulsion is considered the most severe:

1) Type I
3) Type III
2) Type II
5) Type V
4) Type IV

Type I is the most threatening scenario because the FDP tendon retracts into the palm, and vincular and diffusional blood supply is lost. The sheath may be noncompliant after a few days and may not allow passage of the FDP tendon through the sheath in an attempt to repair the stump to its insertion. Additionally, proximal muscle contracture prevents tendon stump advancement.Correct Answer: Type I

1623. (3946) Q4-8197:

When performing pollicization to correct a hypoplastic thumb, the surgeon should rotate the index finger:

1) 120Âº
3) 150Âº
2) 135Âº
5) 180Âº
4) 165Âº

After the index finger is rotated 150Âº, the index finger will be in the ideal location as it mimics the position of where the thumb would have naturally been. This position allows for the greatest amount of grip and pinch strength possible.Correct Answer: 150Âº

1624. (3947) Q4-8198:

For which types of thumb hypoplasia is pollicization the best option:

1) Type I
3) Type IIIA
2) Type II
5) Type I, type II, and type IIIA
4) Type IIIB

Reconstruction is possible and is therefore the best option for thumb hypoplasia in patients with type I, type II, and type IIIA. These three types of hypoplasia can be corrected because the thumb still has most of the bones and muscles intact. Corrective surgery is necessary to correct weak muscles or a tight web space between the thumb and index finger. When a type IIIB exists, reconstruction is not possible and pollicization must be performed.Correct Answer: Type I, type II, and type IIIA

1625. (3948) Q4-8199:

What is the most critical step in pollicization to create a normal-looking thumb:

1) Creating skin incisions with skin flaps that will allow a natural first web space
3) Shortening of the index finger metacarpal
2) Shortening of tendons
5) All of the above
4) Creating a hyperextended joint when stabilizing the metacarpophalangeal joint to the carpus

It is necessary to create a hand with a natural first web space, shorter tendons that allow for natural movement, a shorter metacarpal that ensures the finger will not grow to an unnatural length, and a hyperextended joint to create the most natural-looking hand possible.Correct Answer: All of the above

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1626. (3949) Q4-8200:

All of the following may be present in a child with type IIIA hypoplasia except:

1) Metacarpophalangeal (MP) joint laxity
3) Lack of extensor pollicis longus
2) Web space contracture
5) Thenar muscle atrophy
4) Unstable carpometacarpal (CMC) joint

Type IIIA hypoplasia includes web space narrowing, thenar atrophy, MP joint laxity, and extrinsic tendon abnormalities. Type IIIA is distinguished from a type IIIB by the fact that a stable CMC joint exists. Because a stable CMC joint exists, a reconstruction is the treatment of choice. When the CMC joint is unstable, as in type IIIB hypoplasia, a pollicization is necessary to restore thumb stability.Correct Answer: Unstable carpometacarpal (CMC) joint

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1627. (3950) Q4-8201:

The main 3-4 viewing portal for wrist arthroscopy lies in between which two tendons:

1) Extensor pollicis longus (EPL) and extensor carpi radialis brevis (ECRB)
3) Abductor pollicis longus (APL) and extensor carpi radialis longus (ECRL)
2) Extensor digitorum communis (EDC) and extensor digiti minimi (EDM)
5) Extensor pollicis brevis (EPB) and APL
4) EPL and EDC

The 3-4 portal is the main viewing portal and is located between the third and fourth compartment. This portal is bordered by the extensor digitorum communis (EDC) to the index finger, and the extensor pollicis longus (EPL) can be palpated in the âsoft spotâ 1 cm distal to Listers tubercle. This portal is usually the first portal to be made during wrist arthroscopy.Correct Answer: EPL and EDC

1628. (3951) Q4-8202:

Which of the following ligaments acts as a neurovascular conduit:

1) Long radiolunate
3) Radioscapholunate
2) Radioscaphocapitate
5) Ulnotriquetral
4) Short radiolunate

The radioscapholunate ligament, otherwise known as the ligament of Testut, lacks structural intergrity and acts as a neurovascular conduit. This ligament is visible on the volar side of the wrist from the 3-4 portal in between the long radiolunate and short radiolunate ligaments.Correct Answer: Radioscapholunate

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1629. (3952) Q4-8203:

Complications after wrist arthroscopy occur in what percentage of patients:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

The complication rate after routine wrist arthroscopy is between 2% and 5%.Correct Answer: 5%

1630. (3953) Q4-8204:

Complications after wrist arthroscopy occur in what percentage of patients:

1) 5%
3) 15%
2) 10%
5) 25%
4) 20%

The complication rate after routine wrist arthroscopy is between 2% and 5%.Correct Answer: 5%

1631. (3954) Q4-8205:

The fracture fragment in Bennettâs fracture is located in which of the following areas of the hand:

1) Radiopalmar trapezium
3) Ulnopalmar trapezium
2) Dorsal thumb metacarpal base
5) Radiopalmer lunate
4) Ulnopalmar thumb metacarpal base

As an axial load is placed on the thumb tip, it drives the thumb metacarpal (MC) base in a dorsal-radial direction. As the thumb MC base moves dorsoradially, a fracture is created in the volar, ulnar quadrant of the thumb MC base. Gedda and Moberg describe this as a ligament fracture avulsion. The volar, ulnar quadrant piece usually remains stationary, perhaps migrating a small amount distal the thumb metacarpal base moves dorsoradially, creating a fracture in the volar, ulnar quadrant of the trapezium.Correct Answer: Ulnopalmar thumb metacarpal base

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1632. (3955) Q4-8206:

Which of the following two main soft tissue forces are disrupted by Bennettâs fracture subluxation:

1) Volar beak (anterior oblique) ligament and extensor pollicis longus
3) Posterior oblique ligament and abductor pollicis brevis
2) Volar beak (anterior oblique) ligament and abductor pollicis longus
5) Dorsal radial ligament and abductor pollicis brevis
4) Dorsal radial ligament and flexor pollicis brevis

The volar, ulnar quadrant piece usually remains stationary due to the volar beak ligament. The thumb metacarpal base tends to sublux dorsoradially due to unopposed pull of the abductor pollicis longus and adductor pollicis. The intact volar beak ligament is usually the counterforce the to these two muscles in the static situation. The extensor pollis longus, flexor pollicis brevis, and abductor pollis longus do not have significant involvement in the Bennettâs fracture subluxation. Although the dorsal radial ligament is important for carpometacarpal stability, it is not the ligament attached to the fractures fragment.Correct Answer: Volar beak (anterior oblique) ligament and abductor pollicis longus

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1633. (3956) Q4-8207:

The greatest amount of step-off that is well-tolerated in a Bennettâs fracture is:

1) 0 mm
3) 2 mm to 3 mm
2) 1 mm to 2 mm
5) 4 mm to 5 mm
4) 3 mm to 4 mm

Studies by Livesley, Kjaer-Petersen, and others have shown that patients with fractures with more than a 1-mm step-off after reduction were more likely to develop arthritis at the thumb carpometacarpal joint. Although some studies have not shown functional outcome correlating with the presence of arthritis, Oosterbos and De Boer found that all their patients with fair and poor overall results had nonanatomic reductions. Although a cadaveric study by Cullen has shown that a 2-mm step-off may be acceptable, this contrasts with the clinical evidence currently available.Correct Answer: 1 mm to 2 mm

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1634. (3957) Q4-8208:

When fracture step-off is greater than the accepted limits, which of the following complications is the most common:

1) Arthritis
3) Decreased range of motion
2) Pain
5) All of the above
4) Decreased pinch strength

Studies by Livesley, Kjaer-Petersen, and others have shown that patients with fractures with more than a 1-mm step-off after reduction were more likely to develop arthritis at the thumb carpometacarpal joint. Pain, decreased range of motion, and decreased pinch strength also correlated with these poor outcomes.Correct Answer: All of the above

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1635. (3958) Q4-8209:

Clinically, what is the upper limit of acceptable fracture angulation for a fifth metacarpal neck fracture:

1) 20Â°
3) 50Â°
2) 40Â°
5) 80Â°
4) 70Â°

Although this is controversial, conservatively treated patients with angulations less than 70Â° fared well in two prospective studies. Fourteen percent of patients will have a cosmetic deformity, but operatively treated patients exhibited extensor lag and increased rehabilitation times.Correct Answer: 70Â°

1636. (3959) Q4-8210:

In cadaveric models, when does the biomechanics of fifth finger flexion consistently change in relationship to metacarpal neck fracture angulation:

1) 10Â°
3) 50Â°
2) 30Â°
5) 80Â°
4) 70Â°

Thirty degrees of angulation is the maximum deformity for acceptable fifth finger grip strength. Ali et al showed that fracture angulation of 30Â° results in a significant decrease in the distance between the origin and the insertion of the flexor digiti minimi (FDM). This shortening creates more âslackâ in the FDM muscle and more excursion is wasted as muscle shortening prior to the initiation of metacarpophalangeal (MP) flexion.Correct Answer: 30Â°

1637. (3960) Q4-8211:

Up to how much angulation can be tolerated in the small finger metacarpal shaft fracture:

1) 0Â° to 10Â°
3) 21Â° to 30Â°
2) 11Â° to 20Â°
5) 41Â° to 50Â°
4) 31Â° to 40Â°

The small finger carpometacarpal joint is mobile, which allows the small finger metacarpal to tolerate deformity better than the fixed index and middle finger rays. Thus, 41Â° to 50Â° of angulation can be accommodated by the mobile carpometacarpal joint.Correct Answer: 41Â° to 50Â°

1638. (3961) Q4-8212:

If a metacarpal shaft fracture shortens 4 mm, what will the theoretical amount of extensor lag be at the metacarpophalangeal joint:

1) 0Â°
3) 7Â°
2) 5Â°
5) 20Â°
4) 14Â°

For each 2 mm of shortening, a 7Â° extensor lag exists. Thus, with 4 mm of shortening, there will be a 14Â° extensor lag at the metacarpophalangeal joint.Correct Answer: 14Â°

1639. (4069) Q4-8213:

In a short oblique metacarpal shaft fracture without comminution or bone loss, what is usual amount of maximal shortening that will occur:

1) 1 mm
3) 5 mm
2) 3 mm
5) 9 mm
4) 7 mm

In a cadaveric study, shortening beyond 5 mm was prevented by the tethering effect of the transverse metacarpal ligaments and adjacent metacarpals.Correct Answer: 5 mm

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1640. (3962) Q4-8214:

Which of the following statements is true regarding metacarpophalangeal joint anatomy:

1) The collateral ligaments are lax in flexion.
3) Joint stability is maximal in flexion.
2) The joint volume is highest in flexion.
5) The collateral ligaments originate volar to the axis of flexion.
4) The metacarpal head is spherical.

The collateral ligaments are lax in extension and tight in flexion. The joint volume is highest in extension. The metacarpal head is cam-shaped. The collateral ligaments originate dorsal to the axis of flexion. Due to the tightening of the collateral ligaments over the cam-shaped metacarpal head in flexion, joint stability is maximized.Correct Answer: Joint stability is maximal in flexion.

1641. (3963) Q4-8215:

Which of the following fracture patterns and mechanisms is incorrectly paired:

1) Transverse fracture-direct blow
3) Comminuted fractures with a butterfly fragment-axial compression and bending
2) Transverse fracture-axial load on an extended metacarpophalangeal joint
5) Oblique-torsion and axial load
4) Spiral fracture-torsion

Biomechanically and clinically, fracture patterns are often associated with certain types of force. Transverse fractures occur with a direct blow, comminuted fractures occur with axial compression and bending, spiral fractures occur in torsion, and oblique fractures occur with torsion and axial load.Correct Answer: Transverse fracture-axial load on an extended metacarpophalangeal joint

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1642. (3964) Q4-8216:

Giant cell tumor of tendon sheath commonly occurs in which of the following age groups:

1) Infants (age 0-1 year)
3) Age 10-20 years
2) Age 1-10 years
5) Age 60-70 years
4) Age 30-40 years

Giant cell tumor of tendon sheath is most commonly found in patients in the fourth through sixth decades; therefore, age 30-40 years is the most appropriate answer choice.Correct Answer: Age 30-40 years

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1643. (3965) Q4-8217:

Which of the following clinical features is common in giant cell tumor of tendon sheath:

1) Transillumination
3) Fluctuates in size
2) Erythematous
5) Painless
4) Presents with rapid change in size

Giant cell tumor of tendon sheath is painless. Giant cell tumor of tendon sheath does not transilluminate, as ganglion cyst does. No overlying skin color changes occur. Giant cell tumor of tendon sheath only increases in size and does not fluctuate like a ganglion cyst; it does not present with a rapid increase in size.Correct Answer: Painless

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1644. (3966) Q4-8218:

After plain radiographs of giant cell tumor of tendon sheath are obtained, the following imaging study should be obtained:

1) Computed tomography scan
3) Magnetic resonance image
2) Ultrasound
5) Bone scan
4) Angiogram

Magnetic resonance imaging provides anatomic detail of the soft tissue mass, helps generate a differential diagnosis, and determines if the mass is unifocal or multifocal and where it originates. Giant cell tumor of tendon sheath is a soft-tissue tumor. Computed tomography is best for bone-based tumors. Ultrasound helps localize lesions but does not provide anatomic detail to help determine the type of mass. Although angiograms are useful for vascular tumors such as renal cell carcinoma or arteriovenous malformations, they are not necessary in the evaluation of a soft tissue mass in the hand with features suggestive of giant cell tumor of tendon sheath. A bone scan is useful when malignant bone tumors are suspected rather than benign soft tissue masses.Correct Answer: Magnetic resonance image

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1645. (3967) Q4-8219:

Which of the following cell types is not typically found in giant cell tumors of tendon sheath:

1) Multinucleated giant cells
3) Monocytes
2) Histiocytes
5) Fibroblasts
4) Polymorphonuclear lymphocytes

Multinucleated giant cells, histiocytes, monocytes, and fibroblasts are commonly found in pathologic giant cell tumor of tendon sheath specimens. Polymorphonuclear lymphocytes are typically associated with bacterial infections.Correct Answer: Polymorphonuclear lymphocytes

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1646. (3968) Q4-8220:

A 25-year-old, right-hand-dominant male truck driver presents to the emergency department (Slide 1, Slide 2). The tip of his left ring finger was amputated in a bicycle accident 2 weeks prior. The amputated piece was âsewn back onâ in the emergency department immediately after the accident, but âturned blackâ over the next week. There is no evidence of infection. He states that the appearance of his finger is embarrassing, and he would like it taken care of as soon as possible. Which of the following procedures is the most appropriate:

1) Local debridement, allow to heal by secondary intention
3) Kutler V-Y advancement flap closure
2) Atasoy-Kleinert V-Y advancement flap closure
5) Split-thickness hypothenar skin graft
4) Moberg flap closure

The Atasoy-Kleinert V-Y advancement flap is the best option for transversely oriented fingertip amputations/defects and also for defects with more dorsal than volar tissue loss. The apex of the V is positioned at, or just distal, to the distal interphalangeal joint crease on the volar side of the digit. After incising the V marking, the flap is advanced distally to cover the defect, and the incisions are closed in a Y pattern.

Local, or chemical, debridement and allowing the resulting defect to heal by secondary intention are a viable option, but the patient stated that he would prefer an aggressive treatment protocol because the appearance of his fingertip is so embarrassing.

The Kutler (lateral) V-Y advancement flap is typically used to cover tip defects that demonstrate more volar than dorsal tissue loss. The procedure involves creating V-Y advancement flaps laterally on either side of the affected digit and advancing them toward each other in the midline thereby covering the defect.

The Moberg flap is typically used for reconstruction of thumb amputations. This procedure involves the creation of volar tissue flap that includes the neurovascular bundles on either side of the digit. Its use is cautioned in very distal amputations because excess stretch on the vascular pedicles may lead to necrosis at the tip of the flap. Its use is also cautioned in the fingers because of the difference in orientation of the blood supply compared to the thumb.

A full-thickness, rather than a split-thickness, skin graft is a viable option to manage this patient. Skin grafts for hand reconstruction should be harvested with the âlike replaces likeâ principle in mind, especially when reconstructing the volar skin. Volar hand skin is much thicker and of unique quality when compared with the rest of the body, and therefore, the most appropriate place to harvest a skin graft is the volar surface of the hand.

Correct Answer: Atasoy-Kleinert V-Y advancement flap closure

1647. (3969) Q4-8221:

A 52-year-old, right-hand-dominant watchmaker arrives at the emergency department 30 minutes after the volar soft tissue of his right thumb and index finger was avulsed while using a bandsaw. Physical examination shows 2 cm 3 2 cm wounds involving the distal phalanx of each affected digit. No exposed tendon or bone is present, and no involvement of the joints is noted. The patient requests a treatment option that will retain the most sensation so he can effectively continue in his occupation. Which of the following options is the most appropriate management of this patientâs wounds:

1) Coverage with cross-finger flaps
3) Split-thickness skin grafting
2) Healing by secondary intention
5) Radial free forearm flap
4) Full-thickness skin grafting

Local flaps such as cross finger flaps are good options but require at least two surgeries (inset then division) and can often result in stiffness secondary to the requisite period of immobilization. In addition, local flaps have lesser return of sensibility than the other techniques listed.

Return of tactile sensibility is excellent after healing by secondary intention, but dressing changes for wounds that measure 2 cm 3 2 cm would take months to completely heal.

Skin grafting is the next available option with acceptable sensory return. It can be performed during local anesthesia, requires only one operation, and allows for early motion thereby avoiding stiffness. Studies have shown that full-thickness skin grafts recover sensation better than split-thickness skin grafts.

A radial forearm flap will be excessively bulky, has unacceptable donor site morbidity in this situation, and results in inadequate sensory recovery.

Correct Answer: Full-thickness skin grafting

1648. (3970) Q4-8222:

Which of the following is not considered a part of the triangular fibrocartilage complex:

1) Ulnolunate ligament
3) Dorsal radioulnar ligament
2) Palmar radioulnar ligament
5) Ulnotriquetral ligament
4) Radiolunate ligament

The triangular fibrocartilage complex is made up of the dorsal and palmar radioulnar ligaments, the meniscal homologue, the articular disk, the ulnolunate, and the ulnotriquetral ligaments. The radiolunate ligament is not part of the complex.Correct Answer: Radiolunate ligament

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1649. (3971) Q4-8223:

Which of the following arterial branches does not supply the peripheral 25% of the triangular fibrocartilage complex:

1) Dorsal branch of the anterior interosseous artery
3) Dorsal branch of the radial artery
2) Palmar branch of the anterior interosseous artery
5) Palmar branch of the ulnar artery
4) Dorsal branch of the ulnar artery

The triangular fibrocartilage complex is supplied by both branches of the anterior interosseous artery and the ulnar artery; it is not supplied by the dorsal branch of the radial artery.Correct Answer: Dorsal branch of the radial artery

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1650. (3972) Q4-8224:

Which of the following statements is true:

1) In a wrist with neutral ulnar variance, 20% of the axial load is transmitted across the ulna.
3) In a wrist with 2.5 mm ulnar negative variance, 60% of the axial load is transmitted across the ulna.
2) In a wrist with 2.5 mm ulnar negative variance, 20% of the axial load is transmitted across the ulna.
5) In a wrist with 2.5 ulnar positive variance, 20% of the axial load is transmitted across the ulna.
4) In a wrist with 2.5 mm ulnar positive variance, 600% of the axial load is transmitted across the ulna.

Cadaveric studies have been performed to determine the amount of load across the wrist with various relationships between the radius and ulna lengths. In wrists with neutral ulnar variance (in which the radius and ulna are equal in length), 20% of the load is transmitted across the ulna and 80% is transmitted across the radius. In wrists with negative ulnar variance (in which the ulnar is shorter than the radius), more load is transmitted across the radius and less is transmitted across the ulna. The opposite is true with positive ulnar variance (the ulna is longer than the radius).Correct Answer: In a wrist with neutral ulnar variance, 20% of the axial load is transmitted across the ulna.

1651. (3973) Q4-8225:

Which of the following parameters is not a determinant of the Palmer classification of triangular fibrocartilaginous complex injuries:

1) Location of the lesion
3) Presence of lunatotriquetral ligament injury
2) Presence of ulnar head chondromalacia
5) Presence of ulnocarpal arthritis
4) Size of the lesion

The Palmer classification divides triangular fibrocartilage complex lesions into traumatic and degenerative. Traumatic subclassifications are based on the location of the ligament tear. In the degenerative tear, subclassifications are based on the degree of injury to the triangular fibrocartilage complex and associated chondral and ligamentous injury. Thus, the size of the lesion is not a parameter in the Palmer classification.Correct Answer: Size of the lesion

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1652. (3974) Q4-8226:

What are the components of a Galeazzi fracture-dislocation:

1) Triangular fibrocartilage complex (TFCC) tear, interosseous membrane tear, and radial shaft fracture
3) Interosseous membrane tear and radial shaft fracture
2) Ulnar shaft fracture, interosseous membrane tear, and TFCC tear
5) Wrist radial collateral ligament tear, dorsal intercarpal ligament tear, and ulnar shaft fracture
4) TFCC tear and radial shaft fracture

Only one in vitro study examined the soft tissue constraints of the Galeazzi fracture-dislocation pattern. Moore and colleagues performed a radial osteotomy at the pronator teres insertion of nine cadaveric forearms and then sectioned the TFCC and the interosseous membrane in alternating orders. They found that all three structures (TFCC, interosseous membrane, and radial shaft) must be injured to create a radial shortening of more than 10 mm in relationship to the distal ulna.Correct Answer: Triangular fibrocartilage complex (TFCC) tear, interosseous membrane tear, and radial shaft fracture

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1653. (3975) Q4-8227:

Who are the most common athletes to get medial epicondylitis of the elbow:

1) Tennis players
3) Swimmers
2) Golfers
5) Basketball players
4) Gymnasts

Although medial epicondylitis is called golferâs elbow, tennis players are more likely to have this condition. Medial epicondylitis can occur in any sport such as baseball pitching, javelin throwing, swimming, and gymnastics in which athletes place a significant valgus flexion force on their elbow.Correct Answer: Tennis players

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1654. (3992) Q4-8244:

Indications for replantation include:

1) A crush injury in a patient who smokes
3) An ischemia time of 24 hours
2) A sharp amputation of the thumb in a 15-year-old patient
5) A single digit amputation proximal to the flexor digitorum superficialis (FDS) insertion
4) The use of an amputated part that was immersed in warm water for transport

A sharp amputation, particularly of the thumb, is the best indication for replantation. Crushed digits, prolonged ischemia time, poor condition of the severed part, and single digit loss proximal to the FDS insertion on the middle phalanx are relative contraindications to replantation.

Correct Answer: A sharp amputation of the thumb in a 15-year-old patient

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1655. (3993) Q4-8245:

An amputation through the wrist is an indication for attempted replantation.

1) True
2) False

An amputation through the wrist, palm, or forearm is an indication for attempted replantation. The caliber of the vessels and other structures provides a favorable environment for reconstruction.

Correct Answer: True

1656. (3994) Q4-8246:

Care of an amputated part prior to replantation includes:

1) Painting the amputated part with povidone-iodine
3) Placing the amputated part in a warm saline bath
2) Immersing the amputated part in water
5) Putting the amputated part next to the patientâs body to keep it warm
4) Wrapping the amputated part with saline-soaked gauze and placing it in a plastic bag on ice

The appropriate care of an amputated part includes wrapping it in saline-dampened gauze and placing it on ice in a watertight bag. These actions preserve the tissues and slow cellular death until replantation is attempted. The part should not be immersed, painted with povidone-iodine, or kept next to the body.

Correct Answer: Wrapping the amputated part with saline-soaked gauze and placing it in a plastic bag on ice

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1657. (3995) Q4-8247:

Replants are monitored by:

1) Color
3) Doppler probes
2) Turgor
5) All of the above
4) Temperature measurements

Monitoring of replanted parts postoperatively is accomplished by clinical checks of color or turgor to indicate blood flow. Additional objective monitoring is performed by using Doppler probes to check flow or by measuring temperature differences between the replanted part as compared to other digits.

Correct Answer: All of the above

1658. (3996) Q4-8248:

Complications post-replantation include:

1) Cold intolerance
3) Excessive laxity of the digit
2) Stiffness
5) All of the above
4) A and B only

Complications after replantation include cold intolerance, which may improve over time, and stiffness of the replanted digit, which is generally due to immobility, tendon adhesions, and joint contracture.

Correct Answer: A and B only

1659. (4003) Q4-8255:

Placing some tension on a flexor tendon repair increases the ultimate tensile strength of the repair.

1) True
2) False

Tension on the repair site of a flexor tendon laceration has been shown experimentally to increase the tensile strength of the repair.

Correct Answer: True

1660. (4004) Q4-8256:

Flexor tendon nutrition is derived from:

1) The vincula
3) Synovial diffusion
2) The pulleys
5) A and C only
4) All of the above

Flexor tendon nutrition in the uninjured state is derived via the vincula, which contain blood vessels for nutrition. Injured tendons obtain nutrition via diffusion of synovial fluid. The pulley system does not contribute to flexor tendon nutrition.

Correct Answer: A and C only

1661. (4005) Q4-8257:

Immobilization as a postoperative therapy for flexor tendon repair is recommended for:

1) Lacerations that involve both the flexor digitorum superficialis tendon and the flexor digitorum profundus tendon
3) Children
2) 2-strand tendon repairs
5) Flexor tendon laceration in the thumb
4) Associated pulley rupture

As children have difficulties in following the detailed flexor tendon rehabilitation program that is recommended for adults after flexor tendon repair, it is advisable to completely immobilize them to protect the repair and avoid inadvertent rupture.

Correct Answer: Children

1662. (4006) Q4-8258:

Optimization of early active motion protocols for flexor tendon rehabilitation includes:

1) Multi-strand repair
3) Using passive flexion of the finger to gain flexibility
2) Splinting the digit in extension
5) Ultrasound as an adjunct
4) Therapist hyperextension of the finger

The use of 6- and 8-strand repair techniques allow the flexor tendon repair to withstand the force applied by early active motion protocols. The addition of epitendinous tendon repair also strengthens the repair.

Correct Answer: Multi-strand repair

1663. (4007) Q4-8259:

The splint for early active motion flexor tendon rehabilitation protocols includes:

1) A wrist flexion piece
3) A yoke over the affected finger
2) A dynamic extension outrigger
5) None of the above
4) A hinge at the wrist to allow a tenodesis effect

A hinge at the wrist, which provides a tenodesis effect, allows the patient to passively extend the wrist and flex the fingers in preparation for gentle muscle contraction of the fingers.

Correct Answer: A hinge at the wrist to allow a tenodesis effect

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1664. (4010) Q4-8262:

A 13-year-old boy tears his anterior cruciate ligament (ACL) while playing flag football. What is the preferred graft material for his ACL reconstruction:

1) Bone-patellar tendon-bone autograft
3) Four-strand hamstring tendon autograft
2) Quadriceps tendon autograft
5) Achilles tendon allograft
4) Four-strand hamstring tendon allograft

Due to the patients age, autograft is the preferred option. Also, due to the patientâs age, his growth plates are open and the surgeon is prohibited from using a graft with a bone construct due to the possible damage to the growth plate.

Correct Answer: Four-strand hamstring tendon autograft

1665. (4021) Q4-8274:

What deformity can develop in a mistreated volar PIP joint dislocation?

1) Swan neck deformity
3) Boutonniere deformity
2) Extensor lag
5) Hyperextension deformity
4) Flexion contracture

With volar PIP joint dislocations, there is almost always a disruption of the central slip of the extensor tendon. Because the central slip is involved, the PIP joint will hold a flexed position, and the lateral bands will fall volar to the axis of rotation of the PIP joint. The lateral bands will then exacerbate the flexion at the PIP joint, and due to their pull on the terminal tendon at the insertion on the distal phalanx, the DIP joint will hyperextend. This results in a boutonniere deformity.Correct Answer: Boutonniere deformity

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1666. (4022) Q4-8275:

What percentage of the articular surface must be involved in a dorsal PIP joint fracture dislocation for disruption of the collateral ligaments to occur?

1) 20%
3) 60%
2) 40%
5) 100%
4) 80%

The percentage of articular surface involved differentiates a stable dorsal PIP joint fracture dislocation from an unstable one. It is believed that when the involved fracture fragment is less than 40% of the articular surface, the insertion site of the collateral ligaments is not disrupted and the joint is stable. If more than 40% of the articular surface is fractured, then the insertion of the collateral ligaments is involved and the joint will subsequently be unstable.Correct Answer: 40%

1667. (4023) Q4-8276:

Which structures are disrupted in a lateral PIP joint dislocation?

1) Volar plate by itself
3) Volar plate, both collateral ligaments and central slip
2) Volar plate and both collateral ligaments
5) Volar plate and lateral bands
4) Volar plate and one collateral ligament

When a lateral PIP joint dislocation occurs, failure probably begins with disruption of the collateral ligament either from its origin on the head of the proximal phalanx or its insertion on the base of the middle phalanx. The injury then proceeds through the accessory collateral ligaments and terminates with disruption of the insertion of the volar plate on the middle phalangeal base.Correct Answer: Volar plate and one collateral ligament

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1668. (4024) Q4-8277:

A 22-year old right-hand dominant male college student consumes a large amount of alcohol and falls asleep for eleven hours with his right arm over a chair. When he awakens, he is unable to feel the dorsum of his hand and cannot extend his elbow, wrist, or the metacarpalphalangeal joints of his affected arm. Initial management should consist of

1) Upper Extremity Angiography
3) Non-Steroidal Anti-Inflammatory Drugs (NSAIDs)
2) Observation
5) Emergent Nerve Exploration, with repair if necessary
4) Electromyography

Saturday night palsy is the term used for external compression of the radial nerve, and commonly occurs following the clinical scenario described above. The accepted treatment is observation, as Sunderland et al, described complete relief in all seven patients with Saturday night palsy after a period of observation without any adjunctive treatments. Although NSAIDs can be used if pain is a symptom or there is significant edema, these are not necessarily needed. Electromyography may be indicated if there is no improvement in symptoms after a three to six month period of observation. Emergent nerve exploration is indicated only for open fractures with a known radial nerve injury. There is no role for angiography in treatment of Saturday night palsy.Correct Answer: Observation

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1669. (186) Q5-293:

Flumazenil can be administered to reverse the effects of which of the following drugs:

1) Propofol
3) Midazolam
2) Fentanyl
5) Methohexital
4) Ketamine

Midazolam is a benzodiazepine. Flumazenil is the only commercially available benzodiazepine antagonist. The recommended dose is 0.01 mg/kg every minute until reversed to a maximum dose of 1 mg.

Fentanyl is an opioid and is reversible with naloxone. Flumazenil is a benzodiazepine antagonist and has no effects on the effects of opioids.

Propofol, ketamine, and methohexital have no known antagonists.

Correct Answer: Midazolam

1670. (187) Q5-294:

A 7-year-old boy fell off the jungle gym and landed on his outstretched right arm sustaining a forearm fracture in both bones. The fracture requires reduction. He was given a combination of fentanyl and midazolam for sedation. At his current level of sedation, he is protecting his own airway. His oxygen saturation has dropped slightly to 92% but is stable. He does not display any awareness or discomfort when the fracture is being manipulated. How would you define his current level of sedation:

1) Analgesia
3) Deep sedation
2) Conscious sedation
5) Dissociative amnesia
4) General anesthesia

Deep sedation is the level where most fracture reductions are performed. Patients who are deeply sedated do not respond to verbal or noxious stimuli; they may display both a decreased ability to protect their airway and decreased respiratory drive.

Analgesia is defined as affecting the sensation of pain, however, there is no change in overall awareness.

Conscious sedation is defined as a lessening of awareness, with maintenance of protective reflexes. Patients will respond appropriately to commands and awaken to verbal stimuli. Patients do not respond to commands or noxious stimuli.

With general anesthesia, patients will not respond to verbal or noxious stimuli. Additionally, they lose all of their respiratory drive and ability to protect their airway.

Correct Answer: Deep sedation

1671. (188) Q5-295:

A 14-year-old girl with a history of multiple food allergies and severe asthma was involved in a motor vehicle accident and sustained an isolated right femur fracture. Which of the following medications is the best choice to control her pain:

1) Ketamine
3) Methohexital
2) Morphine
5) Midazolam
4) Meperidine

The goal in this patient is to provide safe, effective, and long-acting analgesia. Meperidine is recommended in this circumstance. It is an opioid that provides intermediate and long-term analgesia. Additionally, it does not cause the associated histamine release and bronchospasm that can occur in patients with asthma and atopia.

Ketamine would provide short-term analgesia, but would also alter the level of consciousness.

Morphine is well known for precipitating bronchospasm in patients with atopia and asthma. Therefore, it would not be the best choice in the scenario presented.

Methohexital (a barbiturate) and midazolam (a benzodiazepine) both cause decreased awareness and have no analgesic properties.

Correct Answer: Meperidine

1672. (189) Q5-296:

Which of the following choices is the best for sedating an otherwise healthy child for a fracture reduction:

1) Morphine, diazepam
3) Fentanyl, diazepam
2) Meperidine, midazolam
5) Fentanyl, midazolam
4) Demerol, phenergan, and thorazine

The combination of fentanyl and midazolam is the closest we have to an ideal drug combination for conscious sedation. Both drugs have commercially available antagonists. Fentanyl and midazolam are both quick-onset and short-duration drugs. When using these two drugs together, there is a significant risk of respiratory depression. It is important to monitor patients closely.

Correct Answer: Fentanyl, midazolam

1673. (190) Q5-297:

A 3-year-old child presents with an obvious right lower extremity abnormality. The left lower extremity has normal alignment and joint function. The right lower extremity displays a severely short thigh with a flexed hip. The right foot and leg are also abnormal. Radiographs reveal a right proximal femur with no femoral head or neck, as well as acetabular dysplasia. There is also fibular hemimelia and two missing lateral rays of the foot. The parents want treatment to preserve the function of the normal leg. The most appropriate treatment is:

1) Observation
3) Van Nes rotation-plasty
2) Right Syme's amputation with knee fusion and prosthetic fitting
5) Equinus prosthesis
4) Femoral lengthening

According to the Aitken classification, the patient has a type C proximal femoral focal deficiency (PFFD). In addition to a severe leg length discrepancy, a dysfunctional foot and ankle are also present. The patient would be best suited with an operative procedure to allow the development of ambulatory skills. The Syme's amputation with knee fusion is the standard procedure for severe PFFD and allows the patient to become proficient in the use of a prosthesis at an early age.

- In a child this young, a rotation-plasty may not be the best option due to a propensity to de-rotate and the weakness of the underdeveloped right ankle.
- For severe PFFD with unstable or dysplastic joints, lengthening is not the best option. If the leg length discrepancy were predicted to be <20 cm and a hip joint were present, then lengthening would be a better choice.
- If the child had a mild leg length discrepancy and was a candidate for lengthening, then an equinus prosthesis would be a reasonable choice until appropriate age for lengthening.

Correct Answer: Right Syme's amputation with knee fusion and prosthetic fitting

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1674. (191) Q5-298:

The most common associated abnormality with proximal femoral focal deficiency (PFFD) is:

1) Tibial hemimelia
3) Absent radius
2) Fibular hemimelia
5) Cardiac defects
4) Congenital scoliosis

Up to 45% of proximal femoral focal deficiency (PFFD) cases have coexisting fibular hemimelia.

- Tibial hemimelia may also have associated abnormalities of the distal femoral physis leading to a varus knee, but PFFD is more common.
- Absent radius is typically associated with thrombocytopenia agenesis radius (TAR) syndrome.
- Congenital scoliosis and cardiac defects are not commonly reported with PFFD.

Correct Answer: Fibular hemimelia

1675. (192) Q5-299:

Osteogenesis imperfecta (OI) is caused by defects in:

1) Calcitonin
3) Type II collagen
2) Type I collagen
5) Osteoclasts
4) Type X collagen

Both quantitative and qualitative defects in type I collagen lead to the various types of osteogenesis imperfecta (OI). Several hundred different collagen I mutations have been found in patients with OI. The less severe forms of OI are caused by mutations in which the defective gene product is not incorporated into collagen, so that formation of cells using the unimpaired strands can continue.Correct Answer: Type I collagen

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1676. (193) Q5-300:

Genetic transmission of osteogenesis imperfecta (OI) is best described as:

1) Autosomal dominant
3) Sex-linked dominant
2) Autosomal recessive
5) Not genetically transmitted
4) Autosomal dominant and autosomal recessive

Depending on the particular mutation involved, osteogenesis imperfecta can be either autosomal dominant or autosomal recessive. Osteogenesis imperfecta occurs because of a defect in type I collagen. The genes for type I collagen are found on chromosomes 7 and 17, and are therefore not sex-linked.

Correct Answer: Autosomal dominant and autosomal recessive

1677. (194) Q5-301:

Which type of osteogenesis imperfecta (OI) is most likely to be confused with child abuse:

1) Type I
3) Type III
2) Type II
5) Type I and Type II
4) Type IV

Osteogenesis imperfecta (OI) type IV can be mild, with normal sclera, normal teeth, and variable levels of hearing impairment. Such cases can be easily mistaken for child abuse.

- While mild forms of OI type I do exist, the presence of blue sclera in all patients throughout life, and a high percentage of hearing impairment and dentinogenesis imperfecta help to rule out a diagnosis of child abuse.
- Child abuse is not a consideration in OI type II because it is an extremely severe form of the disease and results in perinatal death.
- OI type III is a severe progressively deforming form. Over one half of patients have fractures and deformities at birth.
- Short stature, kyphoscoliosis, and triangular faces help to distinguish OI type III from child abuse.

Correct Answer: Type IV

1678. (195) Q5-302:

The most common neurologic complications of osteogenesis imperfecta (OI) is:

1) Intracranial hemorrhage
3) Brainstem compression
2) Subdural hematoma
5) Herniated nucleus pulposes
4) Mental retardation

Basilar impression with brainstem compression is a neurologic sequela of the deforming types of osteogenesis imperfecta (OI). It can be identified by noting that the tip of the dens projects 7 mm or more above McGregor's line on plain film.Correct Answer: Brainstem compression

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1679. (196) Q5-303:

Criteria for diagnosis of neurofibromatosis 1 (NF1) include all the signs below except:

1) CafÃ©-au-lait spots
3) Axillary or inguinal freckling
2) Lisch nodules
5) A distinctive osseous lesion
4) Neurologic deficit

While neurologic deficit may be associated with some of the spinal deformities in neurofibromatosis 1 (NF1), it does not constitute one of the diagnostic criteria.

The diagnostic criteria for NF1 were established by The Consensus Development Conference on Neurofibromatosis at the National Institutes of Health in 1987:

- Six or more cafÃ©-au-lait spots, at least 15 mm in diameter in adults and 5 mm in children.
- Two or more neurofibromas of any type or one plexiform neurofibroma.
- Freckling in the axillae or inguinal regions (Crowe sign).
- Two or more iris hamartomas (Lisch nodules).
- A distinctive osseous lesion, such as sphenoid dysplasia or thinning of long bone cortex, with or without pseudarthrosis.
- A first-degree relative with NF1 by the above criteria.

Correct Answer: Neurologic deficit

1680. (197) Q5-304:

The most common osseous abnormality in neurofibromatosis 1 (NF1) is:

1) Congenital tibial dysplasia
3) Valgus deformity of the ankle
2) Scoliosis
5) Dysplasia of posterior cranial fossa
4) Macrodactyly

Of the many orthopedic manifestations of neurofibromatosis 1 (NF1), including kyphoscoliosis, lordoscoliosis, spondylolisthesis, congenital tibial dysplasia, segmental hypertrophy, cystic bone lesions, and subperiostial bone proliferation, scoliosis is the most common.

Correct Answer: Scoliosis

1681. (198) Q5-305:

The origin of "dumbbell lesions" found in radiographs of patients with neurofibromatosis 1 (NF1) is:

1) Flattening of the intervertebral disk with enlargement on the lateral borders
3) Neurofibromas or meningoceles that protrude through spinal foramina
2) Thinning of the midshaft of the tibia giving this bone the appearance of a dumbbell
5) Two closely spaced cysts within a bone
4) Subperiostial bone proliferation

Intraspinal lesions, such as neurofibromas and meningoceles, that protrude through the neural foramina give the radiologic appearance of a "dumbbell lesion."

- Flattening of the intervertebral disk with enlargement of the lateral borders is not a feature of neurofibromatosis 1 (NF1).
- Tibial dysplasia seen in patients with NF1 lead to anterolateral bowing and does not give the appearance of a dumbbell.
- While subperiostial bone proliferation is seen in NF1, it does not give the appearance of a dumbbell.
- Bone cysts are a recognized complication of NF1, but are not the origin of the dumbbell lesions seen on radiographs.

Correct Answer: Neurofibromas or meningoceles that protrude through spinal foramina

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1682. (199) Q5-306:

Which of the following treatments is contraindicated as treatment for kyphoscoliosis in neurofibromatosis 1 (NF1):

1) Laminectomy over the apex of the kyphosis
3) Bracing
2) Halo traction
5) Posterior spinal fusion
4) Anterior spinal fusion

Laminectomy is contraindicated because the cord is usually compressed anteriorly and resection removes bone necessary for fusion.Correct Answer: Laminectomy over the apex of the kyphosis

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1683. (200) Q5-307:

A 1-year-old girl presents with a right lower extremity abnormality. Her parents report that she has been attempting to stand, but she has not yet walked. Clinically, she has a stiff, flexed, varus right knee with an obvious leg length discrepancy. Her ankle is also in a varus position. She does not spontaneously flex or extend the knee from its flexed position. Radiographs show that she has complete tibial hemimelia. The best choice of treatment at this time for the condition is:

1) Observation
3) Limb lengthening
2) Syme amputation
5) Brown procedure
4) Knee disarticulation

Knee disarticulation eliminates the malformed knee and ankle, allows the use of a prosthesis at an early age to promote ambulation development, and has good long-term results.

- Observation is a poor option due to the severity of the deformity and the need for treatment to develop ambulation.
- Syme's amputation does not address the deformity of the knee.
- In general, joint malformation or instability precludes lengthening procedures.
- The Brown procedure centralizes the fibula at the knee and includes a Syme's amputation for the abnormal ankle. However, a functioning quadriceps is a prerequisite and there is a high likelihood of flexion contracture postoperatively.

Correct Answer: Knee disarticulation

1684. (201) Q5-308:

All of the following are consistent with tibial hemimelia (TH) except:

1) Hypoplastic distal femur
3) Ankle varus
2) Absent extensor mechanism
5) Knee flexion contracture
4) Knee valgus

All of the answers are consistent with tibial hemimelia (TH) except for knee valgus. The knee is typically in varus due to a present fibula in TH. The foot is typically also in equinovarus, and the leg segment is shortened. Knee disarticulation is the best treatment for a complete TH.Correct Answer: Knee valgus

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1685. (202) Q5-309:

A newborn boy presents with an abnormal right lower extremity. The right ankle is at the same level as the midshaft of the right tibia. The foot is also abnormal, and appears to be in a position of equinus and valgus. Radiographs confirm the equinovalgus of the foot, as well as absence of two lateral rays. There is also an absence of the fibula and anterolateral bowing of the tibia. Treatment of the lower extremity should consist of:

1) Trans-tibial amputation
3) Observation
2) Limb lengthening
5) Tibial osteotomy
4) Syme amputation

Currently, the Syme's amputation (or modifications thereof) is the standard treatment for type II fibular hemimelia (FH). The procedure is usually delayed until the child is pulling to stand so that the child can begin walking with a prosthesis. The procedure has reports of excellent long-term results.

- Trans-tibial amputation in a young child is not a good option due to secondary overgrowth of the distal limb residual and need for multiple revision surgeries.
- Limb lengthening may be an option for a child with a mild type I fibular hemimelia with minimal foot and ankle deformity, however, this is not an option for type II FH because of the severe abnormality of the foot and ankle.
- Observation as a form of treatment for a child with a type II FH will be unsuccessful because eventually surgical intervention will be needed due to the leg length discrepancy and prosthetic fitting issues.
- Tibial osteotomy may occasionally be required for the tibial bowing, however, the bowing usually resolves on its own. This procedure does not address the deformity of the foot and ankle.

Correct Answer: Syme amputation

1686. (203) Q5-310:

Fibular hemimelia (FH) can be associated with which of the following abnormalities:

1) Femoral shortening
3) Equinovalgus foot
2) Anterior cruciate ligament (ACL) deficiency
5) All of the above
4) Tarsal coalition

All of the stated abnormalities can be found with femoral hemimelia. It is estimated that 15% of cases have femoral deficiency. Commonly seen in the condition are tarsal coalition, anterior cruciate ligament deficiency, and an equinovalgus foot.Correct Answer: All of the above

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1687. (204) Q5-311:

A 7-year-old boy presents with bilateral high arches. His parents report that they are having difficulty finding shoes that comfortably fit him. The patient denies any foot pain. The father had similar problems with his feet and was diagnosed with a "mild" neurologic condition. On exam, the child has bilateral pes cavus with a supple hindfoot. Treatment of the feet at this time should consist of:

1) Soft tissue procedures alone
3) Triple arthrodesis
2) Soft tissue procedures and calcaneal osteotomy
5) Observation
4) Bracing

The child has a supple deformity secondary to Charcot-Marie-Tooth disease that will progress if untreated. Soft tissue procedures, which may consist of claw toe correction, plantar release, and possibly tendon transfer, are recommended for children younger than 8 years old who have a supple hindfoot.

- The calcaneal osteotomy is reserved for patients with a rigid hindfoot.
- Triple arthrodesis is a salvage procedure reserved for a fixed, painful foot in older children.
- Bracing and observation are not preferred options due to the progressive nature of the disease, and the lack of ability to apply corrective forces to the foot in cavus.

Correct Answer: Soft tissue procedures alone

1688. (205) Q5-312:

A 17-year-old man with Charcot-Marie-Tooth disease (CMT) presents with pain in his right foot. He has had no treatment for the foot in the past. On exam, he is noted to have a rigid pes cavus with hindfoot varus, as well as some weakness in the anterior tibialis and peroneal muscles. Radiographs display the above deformity with degenerative changes in the subtalar joint. Treatment of the foot should consist of:

1) Observation
3) Triple arthrodesis
2) Nonsteroidal anti-inflammatory drugs (NSAIDs)
5) Soft tissue release and calcaneal osteotomy
4) Soft tissue release and tendon transfers

The patient has a rigid, painful deformity with radiographic signs of arthritis. A triple arthrodesis is his best chance at a pain-free, plantigrade foot.

- Observation will not solve his pain due to the deformity and degenerative changes in the foot.
- Nonsteroidal anti-inflammatory drugs (NSAIDs) may help with his pain, however, the degeneration in the foot will continue to progress.
- Because the patient has a rigid deformity, soft tissue procedures will not alleviate the pain.

Correct Answer: Triple arthrodesis

1689. (206) Q5-313:

Which ancillary test is not helpful in the diagnosis of Charcot-Marie-Tooth disease (CMT):

1) Electromyography (EMG)
3) Nerve biopsy
2) Nerve conduction velocity (NCV)
5) Muscle enzymes
4) Muscle biopsy

Charcot-Marie-Tooth disease (CMT) is a neuropathic process resulting in muscle atrophy, therefore, muscle enzyme studies will not be helpful.

- Electromyography (EMG) will confirm the diagnosis by displaying increased amplitude and duration of signals, both of which are indicative of a neuropathic process.
- Nerve conduction velocity (NCV) will also confirm the diagnosis by displaying decreased motor and sensory conduction velocities.
- Nerve biopsy can be helpful by showing loss of myelinated fibers and fibrosis.
- Muscle biopsy will show diffuse atrophy, fibrosis, and adipose tissue within muscle.

Correct Answer: Muscle enzymes

1690. (207) Q5-314:

Which of the following is not a feature of the foot deformity in Charcot-Marie-Tooth disease (CMT):

1) Hindfoot valgus
3) Plantarflexed 1st metatarsal
2) Forefoot pronation
5) Interphalangeal (IP) joint flexion
4) Metatarsophalangeal (MTP) joint hyperextension

Hindfoot varus develops to counter forefoot pronation due to weakness of evertors with preservation of inverter muscle strength.

- The first metatarsal plantarflexes relative to the other metatarsals, leading to pronation of the forefoot.
- Plantarflexion of the first metatarsal occurs as part of the windlass mechanism as the intrinsics and plantar fascia contract.
- As the intrinsics weaken, the toe extensors pull the metatarsophalangeal (MTP) joint into hyperextension as part of the claw toe deformity.
- When the MTP joint hyperextends, the strength of the long toe flexors pulls the interphalangeal joint into flexion contributing to the claw toe deformity.

Correct Answer: Hindfoot valgus

1691. (368) Q5-491:

Which of the following etiologies is not thought to be associated with pseudarthrosis of the clavicle:

1) Prominent cervical ribs
3) Cleidocranial dysplasia
2) Failure of fusion of the medial and lateral clavicular ossification centers
5) Stress lesion from dominant arm
4) Pressure from the higher position of the right subclavian artery

Several theories have been proposed to explain the rare phenomenon of isolated pseudarthrosis of the clavicle. The most accepted theory is pressure from the higher riding right subclavian artery. Pseudarthrosis has also been described in patients with prominent cervical ribs. Finally, some believe that this condition is caused by failure of fusion of the medial and lateral ossification centers of the clavicle. Cleidocranial dysplasia may be associated with pseudarthrosis of the clavicle. There is no evidence that they are related to stress.Correct Answer: Stress lesion from dominant arm

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1692. (369) Q5-493:

The most common presenting symptoms of congenital pseudarthrosis of the clavicle are:

1) Enlarging mass and history of pseudoparalysis at birth
3) Minimally painful or painless prominence with no history of trauma
2) Refusal to use arm, palpable defect, and pain
5) Weakness in the distribution of the upper trunk of the brachial plexus
4) Limitation of abduction to less than or equal to 90Â°

The most common presentation of pseudarthrosis of the clavicle is a painless mass in right the clavicle. There is no history of trauma, and the child uses the extremity normally, with minimal pain, and with no signs of instability.

- There is no history of pseudoparalysis involved with congenital pseudarthrosis.
- Arm use is nearly normal, except for aching with activity.
- There is minimal restriction of motion with the pseudarthrosis, which is one reason it is sometimes not diagnosed until later in childhood.
- There has not been neurologic impairment with this condition.

Correct Answer: Minimally painful or painless prominence with no history of trauma

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1693. (370) Q5-494:

Which of the following statements regarding congenital pseudarthrosis of the clavicle is not true:

1) Congenital pseudarthrosis of the clavicle occurs primarily on the right, rarely bilaterally, and when occurring on the left, congenital pseudarthrosis of the clavicle is usually associated with dextrocardia.
3) Congenital pseudarthrosis of the clavicle is thought to occur due to pressure on the clavicle from the subclavian artery or prominent cervical ribs.
2) Congenital pseudarthrosis of the clavicle is strongly associated with neurofibromatosis and patients often have other pseudarthroses, with the tibia being the most commonly affected site.
5) Impairment of the upper trunk of the brachial plexus rarely develops over time.
4) Treatment for congenital pseudarthrosis of the clavicle involves intercalary bone grafting, plate, and screws.

Pseudarthrosis of the clavicle occurs primarily on the right side. The right predominance has been attributed to pressure on the right clavicle from the subclavian artery and occasionally cervical ribs. Treatment is straightforward with intercalary bone grafting with plate and screws fixation. There is no association with neurofibromatosis and/or pseudarthrosis of the tibia.

- Unlike pseudarthrosis of the tibia, congenital pseudarthrosis of the clavicle is rarely, if ever, associated with neurofibromatosis
- Pressure from the subclavian artery or prominent cervical ribs have been used to explain the observation that the pseudarthrosis is almost always located on the right, and if bilateral, it is associated with bilateral cervical ribs
- Bone graft with plate fixation is the usual treatment for these cases, although there have been reports of success in younger children from simply suturing the periosteum of the two ends together
- Brachial plexus impairment rarely develops in the untreated pseudarthrosis.

Correct Answer: Impairment of the upper trunk of the brachial plexus rarely develops over time.

1694. (373) Q5-497:

Which of the following laboratory findings are consistent with ankylosing spondylitis:

1) Elevated erythrocyte sedimentation rate (ESR), positive antinuclear antibody (ANA), negative rheumatoid factor (RF), and HLA-DR4
3) Elevated ESR, negative ANA, positive RF, and HLA-B27
2) Normal ESR, negative ANA, negative RF, and HLA-B27
5) Normal ESR, positive ANA, positive RF, and HLA-B27
4) Elevated ESR, negative ANA, negative RF, and positive HLA-B27

Diagnostic work-up for an inflammatory autoimmune condition should include an erythrocyte sedimentation rate (ESR), antinuclear antibody (ANA), rheumatoid factor (RF), haplotype, and Lyme titer. The laboratory results most consistent with ankylosing spondylitis are an elevated ESR at the time of an acute exacerbation, negative ANA and RF, and a haplotype of HLA-B27.Correct Answer: Elevated ESR, negative ANA, negative RF, and positive HLA-B27

1695. (376) Q5-500:

Which of the following clinical features distinguishes homocystinuria from Marfan syndrome:

1) Lens dislocation
3) Chest wall abnormalities
2) Scoliosis
5) Delayed intellectual development
4) Tall stature

Patients with Marfan syndrome do not typically have defects in intellectual functioning, while patients with homocystinuria typically do show signs of delayed intellectual development.

Patients with Marfan syndrome and homocystinuria both develop lens dislocations, scoliosis, chest wall abnormalities, and tall stature.Correct Answer: Delayed intellectual development

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1696. (377) Q5-501:

Patients with homocystinuria undergoing lower extremity and spinal surgery must be warned of an increased risk of which complication:

1) Aortic root dissection
3) Venous thromboembolic disease
2) High output heart failure
5) Spontaneous pneumothorax
4) Prolonged ventilator dependence

Arterial and venous thromboembolic disease is common in patients with homocystinuria. Patients are at increased risk for this major complication when undergoing any surgical procedure.

- Unlike patients with Marfan syndrome, patients with homocystinuria do not develop aortic root dilation, aneurysms, mitral valve prolapse with high output heart failure, or spontaneous pneumothoraces.
- Underlying lung pathology is not a feature of homocystinuria, therefore, these patients are not at an increased risk for prolonged ventilatory support.

Correct Answer: Venous thromboembolic disease

1697. (378) Q5-503:

What is the molecular disturbance responsible for the development of homocystinuria:

1) Translocation of chromosome 11 and 22
3) Methionine deficiency
2) Accumulation of cerebrosides in the reticuloendothelial system
5) Pyridoxine deficiency
4) Deficiency of cystathionine b-synthase

The metabolic disturbance responsible for homocystinuria is a deficiency of cystathionine ß-synthase.

- A translocation of chromosome 11 and 22 is a feature of some patients with Ewingâs tumor.
- Accumulation of cerebrosides in the reticuloendothelial system is found in Gaucherâs disease.
- Methionine is present in excessive quantities in homocystinuria because it cannot be converted to cysteine due to the deficiency of cystathionine ß-synthase.
- Pyridoxine deficiency is a secondary feature of the disorder, but it is not the primary cause.

Correct Answer: Deficiency of cystathionine b-synthase

1698. (435) Q5-573:

Which form of chronic inflammatory arthritis is more common in boys than in girls?

1) Polyarticular
3) Systemic onset
2) Pauciarticular
5) Monoarticular
4) Seronegative spondyloarthropaty

Overall, juvenile rheumatoid arthritis (JRA) is much more common in girls. In pauciarticular JRA, the ratio is 4:1 female. In polyarticular JTA, it is 3:1 female, and in systemic JRA the ratio is 1:1. Seronegative spondylarthropathy is more common in males.

The incidence of polyarticular JRA is 3 times higher in girls than in boys. The incidence of pauciarticular JRA occurs 4 times more often in girls than in boys. Girls and boys are equally affected by systemic onset JRA.Correct Answer: Seronegative spondyloarthropaty

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1699. (436) Q5-574:

Which of the following subtypes of juvenile rheumatoid arthritis (JRA) results in the highest risk of developing iritis:

1) Systemic JRA
3) Polyarticular JRA
2) Pauciarticular JRA
5) Eye involvement is not a problem in JRA
4) All are at approximately equal risk

Patients with pauciarticular juvenile rheumatoid arthritis (JRA) have the highest risk of developing iritis, cataracts, and blindness. Polyarticular JRA has the second highest risk. Patients with systemic JRA rarely develop iritis. All newly diagnosed JRA patients should be acutely evaluated and closely followed by an ophthalmologist.

Systemic-onset JRA has the lowest risk of uveitis There is a distinct difference among the types of JRA in terms of risk of eye involvement. Eye involvement is one of the problems physicians should be alert for in order to make an early diagnosis and prevent cataracts and blindness.Correct Answer: Pauciarticular JRA

1700. (437) Q5-575:

In the evaluation of a child with possible inflammatory arthritis, which tests should be ordered for possible juvenile rheumatoid arthritis:

1) CBC, ANA, RF, ESR, CRP, ophthalmology consult
3) CBC, echocardiogram, ANA, RF, and CRP
2) RF, CRP, ANA, ESR, and CBC
5) RF and synovial fluid analysis
4) HLA-typing, ophthalmology consult, ANA, RF, and CBC

Juvenile rheumatoid arthritis (JRA) is primarily a clinical diagnosis; however, routine screening tests should be ordered as part of a routine work-up. All patients should have a CBC, RF, ANA, ESR, CRP, and ophthalmology consult to look for eye involvement. An echocardiogram is not necessary unless a pericardial rub or other cardiac symptoms are present. HLA associations have been made with the different sub-types of the disease; however, this test is not necessary or diagnostic.

- The CBC helps to rule out hematologic malignancy and assess the patientâs general health.
- The ANA looks at the possibility of systemic lupus erythematosus and, if positive at low titer, heralds an increased risk of uveitis.
- A positive RF helps rule in JRA and makes the risk of later erosive disease more likely.
- ESR and CRP are helpful for monitoring disease activity. Ophthalmology consultation will help to rule out or detect uveitis at an early stage.
- HLA typing is not indicated in the typical patient with JRA; it may be useful in the older male with axial symptoms.
- Synovial fluid analysis yields inflammatory fluid in this condition, but no information specific for the diagnosis.

Correct Answer: CBC, ANA, RF, ESR, CRP, ophthalmology consult

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1701. (438) Q5-576:

A 7-year-old child sustained a type 3 closed supracondylar fracture of the humerus 2 hours ago. Neurologic function is intact, but a pulse cannot be found by palpation or doppler. The hand is slightly cool. Your next step is to perform:

1) Arteriogram of the extremity.
3) An attempt at closed reduction of the fracture
2) Injection of lidocaine into the antecubital region
5) Vascular repair
4) Open reduction of the fracture

Closed reduction should be carefully attempted at first, and often a tethered artery will be freed. If no pulse returns, open exploration is indicated if the hand remains cool.

- An arteriogram is rarely indicated because it is unlikely to yield additional information.
- Lidocaine may be instilled if there is spasm at the time of open reduction.
- Open reduction of the fracture is indicated only if closed reduction fails, or if the fracture is open.
- Vascular repair is not the first step; exploration and repair should be carried out only if the pulse does not return after an attempt at closed reduction.

Correct Answer: An attempt at closed reduction of the fracture

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1702. (439) Q5-577:

The nerve most commonly injured at the time of a supracondylar fracture is:

1) Radial nerve
3) Ulnar nerve
2) Median nerve
5) Posterior interosseous nerve
4) Anterior interosseous nerve

The anterior interosseous nerve is the most commonly injured nerve. The anterior interosseous nerve can be tested by asking the patient to make an "O" with the thumb and index fingers, and watching for active flexion of the distal interphalangeal joints.

- The radial nerve is the second most commonly injured, after the anterior interosseous nerve.
- The ulnar nerve is not the most commonly injured at time of fracture but is the most commonly injured at time of treatment.
- The posterior interosseous nerve is rarely injured.

Correct Answer: Anterior interosseous nerve

1703. (440) Q5-578:

A 9-year-old child presents one year after a supracondylar humerus fracture is healed. The elbow is in 15Â° more varus than the other side. Which of the following statements to the family is true:

1) This is likely to be due to growth plate damage in the distal humerus.
3) The deformity is probably due to hyperemia and overgrowth of the capitellum.
2) This is likely to correct fully before the end of growth.
5) The varus will likely lead to an increased likelihood of degenerative joint disease.
4) The deformity is likely due to malposition of the fracture during healing.

Fracture malalignment is the most common cause of cubitus varus.

- Physeal damage is rare after supracondylar fractures.
- Angular malalignment corrects slowly and incompletely in the distal humerus, especially in the coronal plane.
- There is no reason for selective hyperemia of the capitellum in this fracture.
- There is no evidence of predisposition to degenerative joint disease in cubitus varus.

Correct Answer: The deformity is likely due to malposition of the fracture during healing.

1704. (441) Q5-579:

In what region of the United States is Lyme disease most prevalent:

1) Hawaii
3) Northeastern United States
2) Alaska
5) Southern United States
4) Lower Midwestern United States

Lyme disease is most common in the northern United States, Wisconsin, and California; however, the disease can occur anywhere. Vector ticks identified in Europe transmit several variations of Lyme disease.

Hawaii, Alaska, the lower midwestern states, and southern states do not have an increased incidence of Lyme diseaseCorrect Answer: Northeastern United States

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1705. (442) Q5-580:

Which of the following tests is most specific for the diagnosis of Lyme disease:

1) Elevated erythrocyte sedimentation rate (ESR)
3) Negative antinuclear antibody (ANA)
2) Elevated C-reactive protein (CRP)
5) Elevated antibody titer to *Borrelia burgdorferi*
4) Negative rheumatoid factor

The most specific laboratory finding is an elevated antibody titer to *Borrelia burgdorferi*. This test is commonly referred to as a Lyme titer.

All of the mentioned tests are generally seen in Lyme disease, however, elevated erythrocyte sedimentation rate, elevated C-reactive protein, negative antinuclear antibody, and negative rheumatoid factor are all nonspecific.Correct Answer: Elevated antibody titer to *Borrelia burgdorferi*

1706. (443) Q5-581:

Which of the following statements is true regarding Lyme disease:

1) Cardiac and neurologic symptoms are the most common manifestations of the disease.
3) The characteristic skin rash occurs late in the disease and can be permanently disfiguring.
2) Arthritic symptoms primarily affect large joints and a majority of patients are cured with antibiotic therapy.
5) Lyme disease is easy to diagnose and a majority of cases are picked up after a few weeks.
4) Arthritic symptoms often do not fully resolve with antibiotic treatment, with a majority of patients progressing on to a rheumatoid-like destructive arthritis.

Approximately 60% of patients develop arthritic symptoms that primarily affect large joints. The prognosis for most patients is good after treatment with antibiotics.

- Cardiac and neurologic symptoms occur in a minority of patients, however, they can be the most serious symptoms.
- Erythema chronicum migrans is the characteristic skin rash. The rash tends to remit with antibiotic treatment and permanent disfigurement is not typically a problem.
- Only 1%-2% of pediatric patients develop chronic arthritis.
- Lyme disease may be difficult to diagnose because of the numerous possible presentations.

Correct Answer: Arthritic symptoms primarily affect large joints and a majority of patients are cured with antibiotic therapy.

1707. (444) Q5-582:

Lyme disease is caused by which of the following organisms or mechanisms:

1) Group A *Streptococcus*
3) *Vibrio vulnificus*
2) *Borrelia burgdorferi*
5) Autoimmune disorder of unknown etiology
4) Group B *Streptococcus*

Lyme disease was initially thought to be an idiopathic autoimmune disorder; however, in the 1970s, researchers at Yale University identified *Borrelia burgdorferi* as the cause of the disease. The disease is transmitted by a deer tick known as *Ixodes ricinusi*.

Group A streptococcal pharyngitis may be followed by rheumatic fever, but not Lyme disease.

Vibrio vulnificus is the organism responsible for severe soft tissue infections in patients who are exposed to fresh-water shellfish.

Group B *Streptococcus* is a common etiologic agent for necrotizing fasciitis.Correct Answer: *Borrelia burgdorferi*

1708. (445) Q5-585:

The most serious long-term sequela of rheumatic fever is:

1) Skin disfiguration from migratory rash
3) Rheumatic valvular heart disease
2) Disabling arthritis in affected joints
5) Decreased lung capacity secondary to fibrosis
4) Need for long-term prophylaxis for the prevention of relapses

The most serious potential long-term sequela of rheumatic fever is rheumatic valvular heart disease.

- Patients do not develop any permanent skin lesions or joint disability from the disease.
- Some patients require long-term prophylaxis to prevent recurrences, however, this is an inconvenience and not a sequela.
- The lungs are not affected in the acute fever or subsequent relapses.

Correct Answer: Rheumatic valvular heart disease

1709. (446) Q5-586:

Joint pain in rheumatic fever:

1) Affects 2 to 4 large joints over several months
3) Results in long-term disability with joint destruction
2) Responds to aspirin therapy
5) Is a major criterion for diagnosis
4) Is best treated with penicillin G

Joint pain is common in rheumatic fever. It is an intensely painful arthralgia that migrates from joint to joint within hours. The pain responds to aspirin therapy, as well as rest. Although oral penicillin G is used for treatment of the disease, it will not produce rapid resolution of the joint pain. In untreated cases, it can affect up to 16 joints. Most patients are left with no long-term sequelae or disability of the musculoskeletal system from rheumatic fever. Joint arthralgias are minor criteria for diagnosis.Correct Answer: Responds to aspirin therapy

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1710. (447) Q5-587:

Patients with homocystinuria phenotypically resemble patients with:

1) Achondroplasia
3) Marfan syndrome
2) Larsen's syndrome
5) Noonan's syndrome
4) Gaucher's disease

Patients with homocystinuria may phenotypically resemble patients with Marfan syndrome. Patients with homocystinuria and Marfan syndrome are tall with long limbs, arachnodactyly, scoliosis, chest wall deformities, and lens dislocations.

- Achondroplasia is characterized by short stature, frontal bossing, and rhizomelic shortening of the limbs.
- Larsen's syndrome is a disorder characterized by short stature and multiple joint dislocations.
- Gaucher's disease is a lysosomal storage disease characterized by accumulation of cerebroside in cells of the reticuloendothelial system. As in patients with homocystinuria, patients with Gaucher's disease have osteoporosis, however, they do not develop any of the other phenotypic features seen in homocystinuria.
- Noonan's syndrome effects boys and clinical features include short stature, a webbed neck, and cubitus valgus deformities.

Correct Answer: Marfan syndrome

1711. (448) Q5-589:

A genetic defect found in some types of Ehlers-Danlos syndrome (EDS) is:

1) Fibrillin
3) Fibroblast growth factor (FGF) receptor 3
2) Type I collagen
5) Hypoxanthine-guanine phosphoribosyl transferase
4) Dystrophin

Ehlers-Danlos syndrome (EDS) was once described as a single gene disorder affecting type I collagen, but it has since been discovered that EDS is a family of heterogeneous disorders with many described mutations. Type I collagen is defective in EDS type VII and collagen type III is defective in EDS type IV and VIII.

- Fibrillin and fibroblast growth factor (FGF) receptor 3 are defective in Marfan syndrome and achondroplasia, respectively.
- Dystrophin is deficient in muscular dystrophy.
- Hypoxanthine-guanine phosphoribosyl transferase is defective in Lesch-Nyhan syndrome.

Correct Answer: Type I collagen

1712. (449) Q5-590:

Which of the following features differentiates Marfan syndrome from Ehlers-Danlos syndrome (EDS):

1) Joint hypermobility
3) Lens dislocation
2) Scoliosis
5) Joint dislocations
4) Vascular problems

Patients with Ehlers-Danlos syndrome (EDS) and Marfan syndrome may have joint hypermobility, scoliosis, vascular problems, and recurrent joint instability. Patients with Marfan syndrome also develop lens dislocations, and while some patients with EDS exhibit eye problems, it is related to ocular globe fragility. Lens dislocation is not a feature of EDS.Correct Answer: Lens dislocation

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1713. (450) Q5-591:

Which of the following statements concerning Ehlers-Danlos syndrome (EDS) is true:

1) EDS type III is the most severe form of the disease.
3) EDS type VII is characterized by dislocated hips and/or knees at birth.
2) EDS is primarily inherited as an autosomal dominant disorder.
5) Knowing the subtype of the disease does not affect the overall management of the patient.
4) Demonstrating joint hyperlaxity or voluntary dislocation in EDS patients does not damage the joint.

Ehlers-Danlos syndrome (EDS) types I, II, III, and VII are commonly seen by orthopedic surgeons. Type VII is characterized by congenital hip and knee dislocations.

- EDS type III is the mildest form of the disease; the main symptom of this type is hyperlaxity.
- EDS may be inherited via any of the Mendelian patterns.
- Children with EDS should be encouraged not to use their hyperlaxity as a âtrickâ because of potential long-term joint damage that may occur.
- Knowing the subtype of the disease is often helpful in management and perioperative planning because than the surgeon may anticipate operative risks and potential complications.

Correct Answer: EDS type VII is characterized by dislocated hips and/or knees at birth.

1714. (451) Q5-592:

Which subtype of Ehlers-Danlos syndrome (EDS) is caused by lysyl hydroxylase deficiency:

1) EDS type I
3) EDS type III
2) EDS type II
5) EDS type VII
4) EDS type IV

Many of the mutations responsible for the differing subtypes of Ehlers-Danlos syndrome (EDS) have not been identified (EDS types I, II, and III). Lysyl hydroxylase deficiency has been identified as the cause of type IV. A mutation in type I collagen has been identified as the cause of EDS VII.Correct Answer: EDS type IV

1715. (452) Q5-593:

The most common type of chronic inflammatory arthritis in childhood is:

1) Pauciarticular juvenile rheumatoid arthritis
3) Systemic juvenile rheumatoid arthritis
2) Polyarticular juvenile rheumatoid arthritis
5) Reactive arthropathy
4) Seronegative spondyloarthropathy

Forty percent to 60% of children afflicted with juvenile rheumatoid arthritis (JRA) have the pauciarticular subtype. Polyarticular JRA is the second most common type occurring in 30%-40%. Systemic onset JRA is the least common form and occurs in approximately 20% of children. Seronegative spondyloarthropathy is more rare in patients <20 years old.

- Polyarticular JRA comprises about 30%-40% of JRA.
- Systemic onset JRA is the least common form of JRA.
- Seronegative spondyolarthropathy is uncommon in childhood.
- Reactive arthropathy is not a chronic inflammation.

Correct Answer: Pauciarticular juvenile rheumatoid arthritis

1716. (453) Q5-594:

A 14-year-old left-handed boy suffers an avulsion of the medial epicondyle of the distal humerus when landing from a fall. The epicondyle is displaced 7 mm. His physical demands include swimming and lifting boxes. The recommended treatment for this injury is:

1) Open reduction and internal fixation
3) Percutaneous fixation in situ
2) Manipulation and percutaneous fixation
5) Excision of the fragment with reattachment of muscle to bone
4) Splint for 1 week

Unless the fragment is entrapped or significant valgus loading is anticipated, nonoperative treatment is indicated. Range of motion should be started within 1 week.

- Open reduction is only indicated, if the epicondyle was entrapped in the joint, or if significant valgus loading was anticipated.
- The results of nonoperative treatment are just as good as any invasive treatment.
- Excision of the fragment is only indicated, if operative treatment is indicated, and the epicondyle is fragmented.

Correct Answer: Splint for 1 week

1717. (454) Q5-595:

Which of the following statements is true about the medial humeral epicondyle:

1) The medial humeral epicondyle is the first center to ossify in the distal humerus.
3) The medial humeral epicondyle is located anteromedially on the distal humerus.
2) The medial humeral epicondyle usually fuses to the distal humerus at age twelve.
5) The medial humeral epicondyle may ossify from several centers.
4) The medial humeral epicondyle is the origin of the wrist extensor muscles.

The medial epicondyle may have several ossification centers.

- The medial epicondyle is the third center to ossify, beginning at age 4 to 6 years old.
- The medial epicondyle usually fuses near skeletal maturity, at approximately age 15.
- The medial epicondyle is located posteromedially.
- The medial epicondyle is the origin of the flexor-pronator muscles.

Correct Answer: The medial humeral epicondyle may ossify from several centers.

1718. (455) Q5-596:

Which of the following statements is true regarding ankylosing spondylitis:

1) Radiographic changes present early.
3) It is a common inflammatory disorder affecting children < 8 years of age.
2) Characteristic features make it easy to diagnose.
5) Long-term prognosis is poor.
4) It is an inflammation of ligament insertions associated with HLA-B27.

Ankylosing spondylitis is an inflammatory enthesopathy that rarely affects children. Diagnosis is often difficult because the features may be similar to pauciarticular juvenile rheumatoid arthritis. It typically affects males >8 years of age. It is associated with haplotype HLA-B27. The long-term prognosis in these children is generally good.Correct Answer: It is an inflammation of ligament insertions associated with HLA-B27.

1719. (456) Q5-597:

A 4-year-old child injures his elbow and presents with swelling and limitation of voluntary movement. The radiographs show no obvious fracture, but it does show a Baumann angle of 71Â° and an elevation of the posterior fat pad. You tell the parents that this most likely represents:

1) A congenital anomaly with a valgus deformity of the elbow
3) A Salter I physeal separation
2) A medial epicondyle fracture
5) A variation of normal
4) An occult supracondylar fracture

Occult supracondylar fracture was the most common diagnosis assigned after careful study of a clinical series of elevated pediatric posterior fat pads.

- The value for Baumann angle is normally 81Â° - 64Â°. Nothing in this description suggests a congenital anomaly.
- Medial epicondyle fractures are extremely rare before 9 years of age.
- Although a Salter I physeal separation is a possibility, it is a rare injury.
- With an elevation of the posterior fat pad, there is increasing recognition that a fracture exists.

Correct Answer: An occult supracondylar fracture

1720. (457) Q5-598:

A 6-year-old boy sustains a supracondylar fracture of the humerus. The 2 fragments are not completely displaced, but there is some overlap of the medial column and a gap on the lateral column of the distal humerus. Baumannâs angle measures 85Â°-89Â°.The alignment on the lateral film shows no significant translation, but approximately 15Â° of increased extension. The recommended treatment is:

1) Accept this and treat in a long arm cast
3) Closed reduction with the elbow in extension to better monitor the angulation
2) Closed reduction with supination of the forearm and application of long arm cast
5) Open reduction and medial and lateral plate fixation
4) Closed reduction and percutaneous pin fixation

Closed reduction should allow regain of alignment and percutaneous pin fixation will allow it to be maintained.

- The elbow is in 10Â°-15Â° of varus and this will be an objectionable appearance in the future.
- Supination will increase the varus.
- Extension will exacerbate the deformity seen on the lateral and will cause further loss of contact of the fracture fragments.
- Medial and lateral plate fixation is needed in adolescents and adults with intercondylar fractures to allow early range of movement but is excessive treatment for this fracture in young children.

Correct Answer: Closed reduction and percutaneous pin fixation

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1721. (465) Q5-641:

A 6-year-old girl presents with a fracture of the radial neck that is angulated 25Â° compared to the other side. No other abnormalities are seen. The recommended treatment is:

1) Sling and early range of motion
3) Reduction using a percutaneously placed K-wire with intraosseous fixation
2) Reduction using an intramedullary K-wire introduced from a retrograde approach (Metaizeau technique)
5) Open reduction and internal fixation
4) Open reduction without internal fixation

Fractures with angulation <30Â° have an excellent chance of remodeling, and can be left as they are with early range of motion. Reduction using an intramedullary K-wire introduced from a retrograde approach (Metaizeau technique) is indicated mainly for fractures angulated >30Â°.

- Reduction using a percutaneously placed K-wire with intraosseous fixation, while effective, is not needed unless the fracture is angulated >30Â°.
- Open reduction and internal fixation are indicated only if the fracture is angulated >50Â° and does not reduce by one of the manipulative techniques.

Correct Answer: Sling and early range of motion

1722. (466) Q5-642:

A 7-year-old boy falls and suffers a Salter type IV fracture of the proximal radius. The size of the displaced fragment is 40% of the radial head, and it is translated distally by 2 mm. The optimum treatment is:

1) Immobilization for 2 weeks with early range of motion
3) Percutaneous fixation in situ to prevent further displacement
2) Immobilization for 6 weeks with early range of motion
5) Open reduction, internal fixation
4) Excision of the radial head fragment

Because the displacement is likely to be >2 mm, open reduction may lessen the risk of problems with growth and mobility. This is suggested by clinical series.

- The displacement is likely to be greater than the radiograph shows, and growth disturbance is likely. Range of motion at two weeks is too early.
- Percutaneous fixation in situ would still carry a risk of growth disturbance, because the displacement is likely to be more than the plain radiographs show due to the largely cartilaginous nature of the radial head.
- Excision of a fragment this large is likely to produce incongruity of the radio-capitellar joint.

Correct Answer: Open reduction, internal fixation

1723. (467) Q5-643:

A 12-year-old boy sustains a Salter type II fracture of the proximal humerus during a fall. The fracture has an apex angulation of 40Â° anteriorly and laterally. The neurovascular examination is normal. The recommended treatment is:

1) Longitudinal traction in abduction followed by slowly bringing the arm into an abduction (airplane) splint
3) Open reduction and plate fixation
2) Closed reduction and percutaneous pin fixation
5) No formal reduction attempt, rather placement of the arm in a sling
4) Skeletal traction in abduction with an olecranon pin

Recommended treatment involves no formal reduction attempt, rather placement of the arm in a sling. This simple treatment is adequate for all patients with at least 2 years of growth remaining. This is due to the tendency to self-align, the remodeling potential, and the ability to tolerate some deformity in the region with no functional consequence.

- The abduction splint is cumbersome. It is not necessary because simpler means are effective due to the young age and remodeling potential.
- Closed reduction and pin fixation are not needed because adequate remodeling is expected. Any residual deformity is well tolerated in this region. The pins can sometimes cause significant soft tissue irritation in the bulky area of the shoulder.
- Plate fixation is not feasible because of the open physis. It is also not necessary because simpler means are available.
- Skeletal traction is not needed because the humerus will align itself better with time in a dependent position.

Correct Answer: No formal reduction attempt, rather placement of the arm in a sling

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1724. (468) Q5-644:

The most common cause of a pediatric pathologic fracture of the proximal humerus is:

1) Osteochondroma
3) Unicameral bone cyst
2) Osteogenic sarcoma
5) Fibrous cortical defect
4) Codman tumor (chondroblastoma)

The most common cause of a pathologic fracture of the proximal humerus is unicameral bone cyst. This fluid-filled cyst expands and weakens the humerus, often causing a fracture as its first evidence of existence.

- Although the proximal humerus is one of the more common sites of their occurrence, osteochondromas do not significantly weaken the humerus.
- Osteogenic sarcoma is a relatively rare bone tumor, and it does not weaken the bone until it is at an advanced stage.
- Codman tumor (chondroblastoma) is classically described in the proximal humerus, it is rare and typically epiphyseal in location, and does not appreciably weaken the bone.
- Although fibrous cortical defects are common tumors, they rarely present in this way.

Correct Answer: Unicameral bone cyst

1725. (469) Q5-645:

A 6-year-old boy has a painful elbow, with swelling over the region of the olecranon. Radiographs reveal a thin sliver of bone that is displaced 4 mm from the proximal border of the olecranon. Treatment should consist of:

1) Closed treatment in a cast in 90Â° of flexion
3) Open excision of the osseous fragment
2) Closed treatment in a cast in extension
5) No immobilization; early range of motion
4) Open reduction and tension band fixation

Open reduction and tension band fixation is the best method to hold the proximal ulnar apophysis.

- The patient has a âsleeveâ fracture that should be reduced because it is attached to the olecranon apophysis.
- The osseous fragment is attached to the entire olecranon apophysis, which develops a secondary ossification center at age 9.
- With early range of motion, further displacement and/or nonunion may develop.

Correct Answer: Open reduction and tension band fixation

1726. (470) Q5-646:

Which of the following statements is true about the radiographic development of the proximal ulna:

1) A small sliver of a secondary ossification center is present at birth.
3) A secondary ossification center appears at 7 years of age.
2) A secondary ossification center appears at 5 years of age.
5) There is no secondary ossification center for this region.
4) A secondary ossification center appears at 9 years of age.

There is a secondary ossification center developing in children approximately 9 years of age. There is no ossification center in the proximal ulna until the child reaches 9 years old.Correct Answer: A secondary ossification center appears at 9 years of age.

1727. (471) Q5-647:

A 14-year-old boy sustains an intercondylar fracture of the distal humerus. There is a single fracture line into the joint between the capitellum and the trochlea. The medial column of the distal humerus is comminuted, but the lateral column is not. All fragments are highly displaced. Neurovascular status is normal. The recommended treatment is:

1) Olecranon pin traction overhead for 2 weeks and long arm cast
3) Closed reduction and pin fixation
2) Closed reduction and long arm cast
5) Open reduction and dual plate fixation through a posterior approach
4) Open reduction and dual plate fixation through an anterior incision

A posterior approach (Bryan-Morrey or olecranon osteotomy) will facilitate anatomic reduction and rigid fixation sufficient for early range of motion.

- Prolonged traction and cast will result in an incomplete reduction and excessive stiffness.
- A cast alone will result in an incomplete reduction and excessive stiffness.
- Rigid fixation with plates, rather than pins, is required to maintain reduction of these fractures and allow early range of motion.
- An anterior approach will not allow adequate exposure of the distal humerus for articular fixation.

Correct Answer: Open reduction and dual plate fixation through a posterior approach

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1728. (472) Q5-648:

In treating which of the following elbow fractures is it most important to begin early range of motion:

1) Salter I physeal fracture of distal humerus
3) Supracondylar fracture of distal humerus
2) Intercondylar (T-condylar) fracture of distal humerus
5) Lateral epicondyle fracture
4) Lateral condyle fracture

Intercondylar fractures have a significant risk of loss of motion because of the magnitude of injury, intra-articular extension, and older age of patient.

- Salter I physeal fractures typically occur in young children. They usually pose no difficulty with regaining motion after 4 to 6 weeks of immobilization.
- Supracondylar fractures usually are followed by regaining motion after healing despite immobilization of up to 6 weeks or more.
- Patients with this fracture usually regain their motion after healing.
- Because this is a nonarticular fracture, loss of motion is not a high risk.

Correct Answer: Intercondylar (T-condylar) fracture of distal humerus

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1729. (506) Q5-705:

A previously healthy 3-year-old girl presents with 3 weeks of painful torticollis and facial asymmetry. A birth history reveals a normal vaginal delivery with no perinatal complications. The girl has no history of esophagitis or gastrointestinal problems. Her mother reports that approximately 1 month ago, the young girl had an upper respiratory tract infection that has since resolved. The most likely diagnosis is:

1) Muscular torticollis
3) Grisel syndrome
2) Os odontoideum
5) Pseudosubluxation of C2 on C3
4) Sandifer syndrome

Grisel syndrome is an abnormal rotation of the atlantoaxial joint that produces painful torticollis and often follows an upper respiratory tract infection.

- Muscular torticollis is unlikely in this patient because this condition is usually attributed to a difficult delivery, breech presentation, or some type of in utero positioning problem. Furthermore, muscular torticollis usually presents itself within the first 4-6 weeks and has no association with respiratory infections.
- Symptoms associated with os odontoideum consist of neck pain, paresthesia, transient paresis, or myelopathy. Patients with os odontoideum do not have torticollis.
- Sandifer syndrome is a painful torticollis and the abnormal trunk rotation is associated with gastroesophageal reflux disease.
- Pseudosubluxation does not produce painful torticollis.

Correct Answer: Grisel syndrome

1730. (507) Q5-706:

A computerized tomography (CT) scan of the neck reveals an atlantoaxial rotatory displacement with 6 mm of anterior translation. The most likely associated anatomic defect is:

1) Disruption of both the transverse ligament of C1 and the alar ligaments
3) Disruption of the anterior and posterior longitudinal ligaments
2) Odontoid fracture
5) Ossiculum terminale
4) Disruption of the ligamentum flavum between C1 and C2

In order to have anterior displacement of C1 on C2 >5 mm, there must be disruption of both the transverse ligament of C1 and the alar ligaments.

- Odontoid fracture does not disrupt the articulation between the dens and the atlas, therefore, there would be no abnormal diastasis between the atlas and the dens.
- The anterior and posterior longitudinal ligaments attach to the anterior and posterior aspects of the vertebral bodies respectively. Insufficiency does not affect the atlantoaxial articulation.
- Disruption of the ligamentum flavum alone is not thought to result in translation of C1 on C2.
- An ossiculum terminale is a persistent growth center at the tip of the odontoid, but is not indicative of any pathological condition.

Correct Answer: Disruption of both the transverse ligament of C1 and the alar ligaments

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1731. (508) Q5-707:

A 14-year-old ice hockey player had a jersey pulled over his head in a brawl during a game. He finished the game without incident and denies any other traumatic event. The boy presents the following day with a stiff neck tilted to the right side and an inability to bring his head to a neutral position. On more careful physical examination, the boyâs head is tilted to the right 20Â°, rotated to the left 20Â°, and slightly flexed. Attempts at passive rotation to a neutral position produce pain. The exam is otherwise unremarkable. Computerized tomography scans show atlantoaxial rotatory displacement with no anterior displacement of C1 on C2. Treatment should include:

1) Urgent C1 to C2 fusion
3) Head halter traction and NSAIDs
2) Use of a soft collar, exercises, and nonsteroidal anti-inflammatory drugs (NSAIDs)
5) Occiput to C2 fusion
4) Philadelphia collar, Minerva casting, and NSAIDs

A soft collar, exercises, and nonsteroidal anti-inflammatory drugs (NSAIDs) should be tried for 1 week if the diagnosis of atlantoaxial rotatory displacement is made within a week of its onset. The patientâs progress must be followed closely. If NSAIDs and a collar do not work after 1 week, the patient should be hospitalized and head halter traction should be administered along with muscle relaxants. If head halter traction successfully reduces the deformity, the patient should be placed in a Philadelphia collar with Minerva casting for 6 weeks. If the patient has no neurologic findings and no anterior displacement, the condition is likely to resolve with conservative measures alone. If surgery becomes necessary, the occiput should not be included in surgical treatment of atlantoaxial rotatory displacement.Correct Answer: Use of a soft collar, exercises, and nonsteroidal anti-inflammatory drugs (NSAIDs)

1732. (509) Q5-709:

Congenital pseudarthrosis of the clavicle occurs most commonly on which side:

1) Bilateral
3) Left
2) Right
5) The side with the proximal focal femoral dysplasia
4) The side more involved with fibrous dysplasia

Ninety percent of cases are noted on the right side. Ten percent of cases are bilateral and have been associated with bilateral cervical ribs. Only a few cases of left-sided pseudarthrosis have been described and have been associated with dextrocardia.

- Only <5% of cases of congenital pseudarthrosis are on the left.
- Congenital pseudarthrosis is not related to fibrous dysplasia.
- Congenital pseudarthrosis is not related to proximal focal femoral dysplasia.

Correct Answer: Right

1733. (510) Q5-710:

The most common structure to be injured in conjunction with an elbow dislocation is:

1) The ulnar nerve
3) The radial nerve
2) The median nerve
5) The biceps tendon
4) The brachial artery

With an injury rate of approximately 6%, the ulnar nerve is the most common injured structure in an elbow dislocation.

- Median nerve injuries are rare with elbow dislocation. Such injuries may be due to nerve entrapment. If chronic, this may produce the Matev sign of a groove in the distal humerus.
- The radial nerve and biceps tendon are not commonly injured with an elbow dislocation.
- The brachial artery is rarely injured with an elbow dislocation.

Correct Answer: The ulnar nerve

1734. (511) Q5-711:

A 4-year-old girl is brought in for examination by her mother because of a bump on the lateral side of her elbow. The girl is unable to extend her elbow. She falls as much as any child, but no particular injury to the elbow is recalled. Radiographs show a dislocated, enlarged radial head that is convex proximally. There is a proximal radioulnar synostosis. Recommended treatment includes:

1) Radial head excision
3) Open reduction of the radial head and ulnar lengthening osteotomy
2) Open reduction of the radial head and annular ligament reconstruction
5) No treatment
4) Silastic radial head arthroplasty

This child has a congenital dislocation of the radial head, and no treatment is indicated unless the forearm is fixed in a position of extreme malrotation.

- Radial head excision should only be performed if there is pain and the child is skeletally mature.
- Silastic radial head arthroplasty has a significant risk of particulate synovitis.

Correct Answer: No treatment

1735. (512) Q5-712:

A 6-year-old child falls and suffers a fracture of the elbow. The tenderness is mostly lateral. A fracture line may be seen separating a fragment of the humeral metaphysis and physis 3 mm from the lateral portion of the elbow, but the distal extension of the fracture cannot be visualized because of lack of ossification at this age. Treatment should consist of:

1) No immobilization and early range of motion
3) Application of a long arm cast for 8 weeks
2) Application of a long arm cast for 4 weeks followed by early motion
5) Open reduction and plate fixation
4) Closed reduction and percutaneous pin fixation

Closed reduction and pin fixation should be attempted for all lateral condyle fractures that are displaced more than 2 mm. If closed reduction is not successful, open reduction should be performed.

- This is a lateral condyle fracture; nonunion may result with no immobilization and early range of motion.
- With more than 2 mm of displacement, reduction and fixation should be carried out.
- Plate fixation is not feasible because of the presence of the physis. Rigid fixation beyond the use of pins is not required.

Correct Answer: Closed reduction and percutaneous pin fixation

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1736. (513) Q5-713:

The following is the most common complication of lateral condyle fractures:

1) Radial nerve palsy
3) Heterotopic ossification
2) Compartment syndrome
5) Posterior interosseous nerve injury
4) Nonunion

Nonunion occurs more commonly after lateral condyle fracture than following most childrenâs fractures because the fracture line is predominantly intra-articular and not always adequately reduced and immobilized.

- Radial nerve injury, compartment syndrome, heterotopic ossification, and posterior interosseous nerve injury are uncommon with lateral condyle fractures.

Correct Answer: Nonunion

1737. (514) Q5-714:

The most common nerve injury in a Monteggia fracture and the type of Monteggia fracture with which it is most commonly found is:

1) Ulnar nerve, type I
3) Posterior interosseous nerve, type III
2) Posterior interosseous nerve, type IV
5) Median nerve, type III
4) Median nerve, type I

The posterior interosseous branch of the radial nerve is injured in 10%-20% of Monteggia fractures. Most cases occur at the time of fracture, but some occur later. Spontaneous resolution is the usual outcome.

- The ulnar nerve has only been reported injured in one case.
- The posterior interosseous nerve is the most commonly injured, at 10-20%, but type I and type III are the most common types affected.
- The median nerve is the second most commonly injured, after the radial nerve.

Correct Answer: Posterior interosseous nerve, type III

1738. (515) Q5-715:

A 7-year-old girl is seen because of a persistent anterior dislocation of the radial head that occurred 2 months ago with an ulna fracture. The ulna has healed but has 25Â° of angulation. Her family would like to have this fixed to remove the prominence in the hope of preventing future joint degeneration. The recommended treatment is:

1) Closed reduction of the radial head
3) Open reduction and annular ligament reconstruction
2) Open reduction and pin fixation of the radial head
5) Open reduction, radial shortening, and annular ligament reconstruction
4) Open reduction, annular ligament reconstruction, and ulnar osteotomy

The combination of open reduction, annular ligament reconstruction, and ulnar osteotomy should correct all of the components of the deformity.

- Closed reduction is not successful beyond 1-2 weeks after injury.
- Because of the 25Â° ulnar bow, recurrence is likely, and ulnar osteotomy is indicated.
- An ulnar osteotomy should be included to prevent recurrence.

Correct Answer: Open reduction, annular ligament reconstruction, and ulnar osteotomy

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1739. (516) Q5-716:

A 6-year-old patient has an acute proximal ulnar fracture with an apex posteriorly, as well as a radial head dislocation. Treatment at this stage should consist of:

1) Closed reduction and immobilization in supination and flexion more than 90Â° in a long arm cast
3) Closed reduction and intramedullary rod fixation of the ulna
2) Closed reduction and immobilization in extension in a long arm cast
5) Open reduction of the radial head and annular ligament reconstruction
4) Open reduction of the radial head and plate fixation of the ulna

Extension will reduce the dislocation and the fracture.

- This type II Monteggia proximal fracture is best immobilized in extension.
- An intramedullary rod is indicated only if closed treatment fails.
- Open reduction of the radial head and plate fixation of the ulna are indicated only if closed treatment fails.
- Annular ligament reconstruction is indicated only if the dislocation is unreduced for more than 1 to 2 weeks.

Correct Answer: Closed reduction and immobilization in extension in a long arm cast

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1740. (517) Q5-717:

A 5-year-old patient sustains a fracture of the ulna with apex anteriorly, as well as an anterior dislocation of the radial head. The recommended treatment is:

1) Closed reduction with elbow flexed at least 90Â° and somewhat supinated
3) Closed reduction with the elbow flexed and the forearm in maximal pronation
2) Closed reduction with the elbow in extension
5) Open reduction of the radial head, annular ligament repair, and closed reduction of the ulna
4) Closed reduction of the radial head and intramedullary rod of the ulna

Flexion to at least 90Â° helps redirect the radial head, as does partial supination.

- Extension of the elbow will increase the tendency to dislocate.
- Pronation of the forearm will increase the tendency to dislocate.
- An intramedullary rod is needed only if closed treatment fails.
- Open reduction is required only if closed treatment fails.

Correct Answer: Closed reduction with elbow flexed at least 90Â° and somewhat supinated

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1741. (518) Q5-718:

A 2-year-old boy fell 4 feet from a countertop and landed on his outstretched hand. There is circumferential swelling and tenderness. Radiographs show no fracture, but the posterior fat pad elbow is elevated and the radius and ulna are translated slightly laterally on the anteroposterior view, and posteriorly on the lateral view. The most likely diagnosis is:

1) Undisplaced supracondylar fracture
3) Lateral condyle fracture
2) Transphyseal fracture of the distal humerus
5) Congenital elbow dislocation
4) Traumatic elbow dislocation

The separation occurs through cartilage, so it is not visible as a fracture on plain films. However, the translation indicates a problem and elbow dislocation does not occur with any frequency at this age.

- An undisplaced supracondylar fracture would not produce translation of the radius and ulna.
- A lateral condyle fracture would not produce translation of the ulna.
- Traumatic dislocation is extremely uncommon in this age group.
- Congenital elbow subluxation would not account for the swelling and tenderness. This is an extremely rare condition.

Correct Answer: Transphyseal fracture of the distal humerus

1742. (519) Q5-719:

A physeal fracture-separation of the distal humerus is seen in an 18-month-old boy. When the parents ask about the prognosis after this injury, you tell them that the most common complication is:

1) Cubitus varus
3) Ulnar nerve injury
2) Median nerve palsy
5) Undergrowth of the humerus
4) Brachial artery injury

Cubitus varus occurred in seven out of twelve physeal fracture separations of the distal humerus in one series. This most likely occurred due to malalignment or avascular necrosis of the trochlea.

- Median nerve injury, ulnar nerve injury, and brachial artery injury are extremely uncommon after this injury because the surfaces of the metaphysis and the physis are relatively smooth in comparison to supracondylar fractures. Also, these injuries are relatively low-energy.
- Growth plate damage causing undergrowth is rare after this fracture.

Correct Answer: Cubitus varus

1743. (520) Q5-720:

slide 1

A 12-year-old boy presents to the emergency department after being struck by a car (slide 1). His only complaint at the time of presentation is right ankle pain. After obtaining an excellent reduction and casting the leg, the risks of a future growth disturbance through the involved physis must be discussed with the family. What are the chances of a significant growth disturbance of his leg:

1) < 1%
3) 10% to 15%
2) 2% to 3%
5) 80% to 90%
4) 45% to 55%

This is a Salter-Harris type II fracture of the distal tibia. The distal tibia is at moderate risk for growth arrest after physeal injury. The average incidence of growth disturbance is 15% for all physeal injuries in this area. The marked displacement and mechanism of injury in this patient increase the risk of permanent physeal damage. The patientâs age and remaining growth also increase the likelihood of a growth arrest causing a significant deformity or leg length discrepancy.Correct Answer: 10% to 15%

1744. (521) Q5-721:

Three years after a Salter-Harris type I physeal fracture of the right distal femur, a 12-year-old boy presents with complaints of knee pain and a limp. On examination, the boy has a valgus alignment of his right knee and a 2-cm leg length discrepancy with the right leg shorter than the left. Plain radiographs and a scanogram showed 30% growth plate closure with a femoral-tibial angle of 12Â° of valgus and 2.5 cm of shortening of the right femur. What is the best treatment:

1) Lengthening procedure on the right leg
3) Physeal bar resection of the right distal femur and opening wedge lateral osteotomy
2) Varus osteotomy of the right femur and bilateral distal femur epiphyseodesis
5) Completion of distal femoral epiphyseal closure
4) Right medial hemiepiphyseal stapling

The bar resection has a reasonable chance of success. The angulation can be corrected by the osteotomy and the length would be partially corrected.

- Correction of the length (2 cm) is less important than prevention of future angulation and shortening.
- At 12 years old, if varus osteotomy of the right femur and bilateral distal femur epiphyseodesis were performed, the patient would be sacrificing 6 cm of leg length which most patients would consider unacceptable.
- Right medial hemiepiphyseal stapling and completion of distal femoral epiphyseal closure would neither produce significant length equalization nor correct the angulation.

Correct Answer: Physeal bar resection of the right distal femur and opening wedge lateral osteotomy

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1745. (522) Q5-722:

Two years after a Salter-Harris type II fracture of the right distal femur, a 12-year-old girl presents to the clinic with knee pain. On examination, she is found to have a valgus alignment of the right knee and a 3-cm leg length discrepancy with the right leg shorter than the left leg. The scanogram confirms 3 cm of shortening in the right femur. The next step in the management of this patient is:

1) Obtain a magnetic resonance image of the right distal femoral physis
3) Obtain a bone scan
2) Obtain a computed tomography scan of the right distal femoral physis
5) Patientâs return in 9 months for a repeat scanogram
4) Obtain a single photon emission computed tomography scan

A magnetic resonance image of the right distal femoral physis provides the best detail of the physis if the correct region and sequences are ordered.

- A computed tomography scan is not the preferred method to allow visualization of the physis.
- A bone scan or photon emission computed tomography scan will not highlight a bar of the physis.
- Waiting 9 months would allow for worsening of the deformity.

Correct Answer: Obtain a magnetic resonance image of the right distal femoral physis

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1746. (523) Q5-725:

The mutations underlying Stickler syndrome have been identified in which of the following molecules:

1) Type I collagen
3) Fibrillin
2) Type II collagen
5) Fibroblast growth factor receptor protein
4) Sulfate transport protein

Type II collagen is abnormal in the classic form of Stickler syndrome, but in a few patients, type XI collagen has been found to be the causative mutation.

- Type 1 collagen is predominant in bone and is abnormal in osteogenesis imperfecta, for example. Stickler syndrome is characterized by a defect in type II collagen.
- Fibrillin is abnormal in Marfan syndrome, but in Stickler syndrome, the causative abnormalities have been found in type II collagen.
- Sulfate transport protein has been found abnormal in diastrophic dysplasia
- Fibroblast growth factor proteins are abnormal in achondroplasia and hypochondroplasia, but the basic defect in Stickler syndrome is type II collagen.

Correct Answer: Type II collagen

1747. (581) Q5-817:

A 15-month-old child has bowing of the legs. Examination reveals a 3 cm distance between the femoral condyles and a thigh-foot angle of 20Â° internal. Radiographs reveal 10Â° varus of the mechanical axis, no evidence of skeletal dysplasia, and a metaphyseal-diaphyseal angle of 9Â° on each side. Recommended treatment is:

1) Full-time bracing with a knee-ankle-foot orthosis
3) Bilateral hemiepiphyseal stapling of the lateral tibia
2) Bilateral oblique osteotomies of the proximal tibia
5) Reassurance to parents that the legs will develop normally; no further follow-up
4) Re-examination in 6 months

Although a diagnosis of Blount disease cannot be made at this time, the disease cannot be ruled out. The patient should be rechecked in 6 months by an experienced examiner. However, if the parents are reliable, they can be told that they do not need to return if the childâs legs develop a normal shape in 6 months.

- The diagnosis of pathologic varus cannot be made; therefore, no treatment is indicated.
- The findings described are not outside of normal limits; surgery is not necessary.
- No pathologic diagnosis has yet been made. In addition, stapling is not an indicated form of treatment for such a young child.
- Although a pathologic condition has not been diagnosed, one cannot be ruled out either at this stage.

Correct Answer: Re-examination in 6 months

1748. (582) Q5-818:

An 11-year-old girl is observed for legs that have been bowed for the past 5 years. She has a mechanical axis that is in 26Â° of varus, a medial tibial plateau slope of 8Â°, a tibial joint angle of 15Â° varus, and a femoral joint angle of 10Â° varus. Her physis appears open. Recommended treatment is:

1) Tibial valgus osteotomy
3) Tibial and femoral valgus osteotomy
2) Femoral valgus osteotomy
5) Brace treatment
4) Medial tibial plateau elevation

Both a tibial and a femoral valgus osteotomy are necessary to correct significant deformities in these areas.

- A tibial valgus osteotomy is necessary but not sufficient. The femoral joint angle is off by 13Â° from the normal angle.
- A femoral valgus osteotomy is necessary but not sufficient. The tibial joint angle is off by 15Â° of varus.
- A tibial plateau elevation is not necessary for this mild degree of plateau depression.
- Brace treatment is not recommended for patients older than 3 years of age.

Correct Answer: Tibial and femoral valgus osteotomy

1749. (583) Q5-819:

The radiographic feature that is most characteristic of infantile Blount disease is:

1) Widening and irregularity of the entire proximal tibial physis
3) Focal bowing of the distal medial femur
2) Poor bone mineralization
5) External tibial torsion
4) Focal bowing of the proximal medial tibia

Bowing is focally located at the proximal medial tibia in infantile Blount disease.

- The physis may be widened medially, but it is normal laterally.
- Bone mineralization is not impaired in Blount disease.
- Bowing is focally located at the proximal tibia, not the distal femur.
- Blount disease is associated with internal, not external, tibial torsion.

Correct Answer: Focal bowing of the proximal medial tibia

1750. (584) Q5-820:

Marfan syndrome is now recognized as a defect in the following molecule:

1) Fibrillin-1
3) Type II collagen
2) Type I collagen
5) Type IX collagen
4) Sulfate transport protein

Marfan syndrome is due to an abnormality in fibrillin-1, a component of elastic connective tissue.

- Type I collagen is most commonly abnormal in osteogenesis imperfecta. Type I collagen is normal in Marfan syndrome.
- Type II collagen is a homotrimer (encoded by a single gene) and is mainly located in cartilaginous tissues. Type II collagen is abnormal in spondyloepiphyseal dysplasia congenita and Stickler syndrome.
- The sulfate transport protein is important for cartilage formation. The sulfate transport protein is impaired in diastrophic dysplasia.
- Type IX collagen is also found in cartilage. Type IX collagen is abnormal in some forms of multiple epiphyseal dysplasia.

Correct Answer: Fibrillin-1

1751. (585) Q5-821:

A 15-year-old basketball player has mild scoliosis, pes planus, pectus carinatum, and long slender fingers. In order to help determine if he has Marfan syndrome and should be allowed to continue playing basketball, it is most useful to order a:

1) Cardiac echo
3) Slit lamp examination
2) Magnetic resonance image of the lumbosacral spine
5) Dermal fibroblast assay
4) Chest radiograph

A cardiac echo will give information about enlargement of the ascending aorta, as well as the valves. This is the most important information for activity recommendations and patient prognosis.

- A magnetic resonance image (MRI) of the lumbosacral spine will either rule in or out dural ectasia, but a MRI has no clinical importance for activity recommendations.
- A slit lamp examination is not as important as a cardiac echo in making sport recommendations.
- A chest radiograph may be helpful, if the patient is suspected of having a pneumothorax.
- A dermal fibroblast assay is useful in assessing collagen, such as in osteogenesis imperfecta, but it is not helpful in diagnosing Marfan syndrome.

Correct Answer: Cardiac echo

1752. (586) Q5-823:

The following skeletal feature helps to establish a diagnostic level of major skeletal involvement in Marfan syndrome:

1) Hyperextensible knees
3) Standing height over 2 m
2) Atlantoaxial subluxation
5) Pectus carinatum
4) Increased thoracic kyphosis

Pectus carinatum has a high diagnostic value for Marfan syndrome.

- Hyperextension of the knees is not common in patients with Marfan syndrome. This skeletal feature is seen in many other conditions; therefore, it has low diagnostic specificity.
- Atlantoaxial subluxation is rare in Marfan syndrome, but is common in some of the skeletal dysplasias.
- Although patients with Marfan syndrome are generally tall, height is too nonspecific to be a helpful diagnostic criterion.
- Kyphosis is not a skeletal diagnostic criterion.

Correct Answer: Pectus carinatum

1753. (587) Q5-824:

A 12-year-old girl has a scoliosis of 36Â° from T2-T7 and 15Â° from T7-L1. She is premenarchal. The following treatment is recommended:

1) Charleston bending brace
3) Milwaukee brace
2) Boston overlap brace
5) Posterior spinal fusion
4) Lateral electrical spinal stimulation

The Milwaukee brace offers the best chance of controlling this curve.

- Charleston bending braces are not effective for curves larger than 35Â°.
- Boston overlap braces are not effective for curves with an apex above T8.
- Lateral electrical spinal stimulation has been proven ineffective for scoliosis.
- This curve is not large enough to pose a recommend fusion.

Correct Answer: Milwaukee brace

1754. (588) Q5-825:

All of these findings are features of patients with Scheuermann kyphosis, except:

1) Vertebral wedging
3) Schmorl nodes
2) Endplate irregularity
5) Back pain
4) Truncal obesity

Obesity is not any more common in patients with Scheuermann kyphosis than in the general population.

- Vertebral wedging is a common feature of Scheuermann kyphosis.
- Endplate irregularity is a common feature of Scheuermann kyphosis.
- Schmorl nodes are a manifestation of the disordered behavior of the vertebral endplates under load.
- Back pain is common in Scheuermann kyphosis.

Correct Answer: Truncal obesity

1755. (589) Q5-826:

An 18-year-old man is seen in the office because of back pain in the thoracic region. He has a kyphosis of 65Â°, a slight wedging in the midthoracic spine, and a Risser sign of 4. Recommended treatment includes:

1) A program of strengthening and stretching exercises
3) A Boston brace
2) A Milwaukee brace
5) An anterior and posterior spinal fusion
4) A posterior spinal fusion

Exercises must be the first treatment for this patient because he is too mature for brace treatment.

- Brace treatment is not indicated for someone of this skeletal maturity.
- Surgery is not indicated unless the patient fails conservative treatment.

Correct Answer: A program of strengthening and stretching exercises

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1756. (590) Q5-827:

Prior to treatment, this pathologic finding characterizes clubfoot:

1) The talar head and neck are deviated medially.
3) The navicular is positioned more laterally than normal.
2) The dome of the talus is flattened.
5) The tendoachilles inserts in a more lateral position than normal.
4) The foot has a rocker deformity.

The talar head and neck are deviated medially. This deformity cannot be corrected surgically but may improve with growth.

- The dome of the talus is not originally flattened, but it may become this way after repeated manipulation.
- The navicular is positioned more medially than normal and may touch the medial malleolus.
- The foot has either a normal arch or a cavus deformity (the opposite of a rocker bottom). The rocker bottom foot may develop as a result of over-vigorous manipulation of a clubfoot against a tight heelcord.
- The tendoachilles inserts are more medially positioned than normal on the calcaneus.

Correct Answer: The talar head and neck are deviated medially.

1757. (591) Q5-828:

In the surgical correction of a clubfoot, the following clinical or radiographic finding indicates that a child should have a plantar release:

1) Anterior extrusion of the talus
3) Medial subluxation of the calcaneocuboid joint
2) Inferior subluxation of the calcaneocuboid joint
5) Lack of ability to dorsiflex the ankle
4) Plantarflexion of the first ray

Plantarflexion of the first ray, especially if the first ray is not colinear with the talus on the lateral radiograph, should serve as an indication for a plantar release.

- Anterior extrusion of the talus is common because of the tightness of the Achilles tendon and the posterior capsule.
- Inferior subluxation of the calcaneocuboid joint is not a feature of clubfoot.
- Medial subluxation of the calcaneocuboid joint, in combination with the clinical appearance of a curved lateral border of the foot, should serve as an indication for a lateral release, not a plantar release.
- Inability to dorsiflex the ankle is an indication for a posterior release.

Correct Answer: Plantarflexion of the first ray

1758. (592) Q5-830:

Hip subluxation is most likely to occur in patients with this type of cerebral palsy:

1) Athetoid
3) Hemiplegic
2) Diplegic
5) Monoplegic
4) Total involvement

Patients with total involvement have the highest degree of axial muscle imbalance; therefore, they have the highest risk of hip subluxation (greater than 50%).

- Hip dysplasia is uncommon in athetoid cerebral palsy (CP).
- Diplegic CP has the second highest incidence of neuromuscular hip dysplasia, but total involvement has the highest rate.
- Hip subluxation is not common in hemiplegic CP.
- Monoplegia is a rare form of CP with a low rate of subluxation.

Correct Answer: Total involvement

1759. (593) Q5-831:

A 13-year-old boy sustains a Salter II fracture of the proximal humeral epiphysis. On radiograph, there is a 40Â° varus angulation and a 30Â° apex anterior angulation. Recommended treatment includes:

1) Closed reduction and abduction cast
3) Closed reduction and percutaneous pin fixation
2) Closed reduction and sling
5) Application of a sling and swathe
4) Open reduction and percutaneous pin fixation

Spontaneous partial reduction will occur when the patient becomes upright, and there is good remodeling potential due to growth.

- Closed reduction and abduction cast is not necessary because of the patientâs age, remodeling potential, and range of motion available in the joint.
- A formal attempt at closed reduction is not necessary because there is no way of holding it without internal fixation. This process will occur naturally to a large degree when the patient becomes upright.
- Open reduction and percutaneous pin fixation poses a risk of pin tract infection because of the large amount of muscle traversed. This procedure is not necessary because of the good results with conservative treatment.

Correct Answer: Application of a sling and swathe

1760. (594) Q5-832:

A 12-year-old girl sustains a closed type III Monteggia fracture. One week after closed reduction, the radial head resubluxates and the ulna bows. The next step of treatment is:

1) Repeat closed reduction and a long arm cast
3) Reduce and internally fix the ulna and close-reduce the radial head
2) Reconstruct the annular ligament using a strip of triceps fascia
5) Reduce and pin the radial head
4) Reduce and internally fix the ulna and open-reduce the radial head

Once the ulna is predictably reduced, the radial head has a good chance of staying reduced.

- Repeat closed reduction and a long arm cast has a significant chance of redisplacement. If further time passes, radial head reduction will be difficult.
- Annular ligament reconstruction is only indicated if there is late subluxation (after several weeks) that does not reduce with closed means.
- Once the ulna is realigned and fixed, closed reduction of the radius must be tried next.
- Pinning of the radial head should be a last resort because of the risk of breakage and stiffness.

Correct Answer: Reduce and internally fix the ulna and close-reduce the radial head

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1761. (595) Q5-833:

The following parameter is the most useful in predicting the need for surgical correction of developmental coxa vara:

1) The range of active abduction
3) The acetabular index
2) The epiphyseal extrusion index
5) Presence of a Trendelenburg gait
4) The Hilgenreiner-epiphyseal angle

The Hilgenreiner-epiphyseal angle is a measure of the shear stress on the femoral neck. A value greater than 60° is an indication for surgery.

- The range of abduction does not directly reflect the mechanical stresses on the femoral neck that may need correction.
- The epiphyseal extrusion index is a parameter used in Perthes disease.
- The acetabular index is used in developmental hip dysplasia. It is usually essentially within normal limits, even in severe coxa vara.

Correct Answer: The Hilgenreiner-epiphyseal angle

1762. (596) Q5-834:

A 7-month-old girl is newly seen for a dislocation of the left hip. The newborn exam was unremarkable; there was no history of trauma or evidence of spasticity. Recommended treatment includes:

1) Exam, arthrogram and attempted closed reduction under anesthesia to guide treatment
3) Open reduction through a medial approach
2) Pavlik harness
5) A Salter osteotomy
4) Open reduction through a lateral approach

An exam under anesthesia and arthrogram should be performed. Closed reduction must be performed if the hip reduces with a medial dye pool less than 4 mm and a safe zone greater than 20Â°.

- The Pavlik harness is not strong enough to hold an infant older than 4 to 6 months.
- Open reduction is reserved for hips that do not reduce by closed means.
- A Salter osteotomy is only indicated if the hip is still unstable after an open reduction.

Correct Answer: Exam, arthrogram and attempted closed reduction under anesthesia to guide treatment

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1763. (597) Q5-835:

A 4-year-old girl has unilateral idiopathic avascular necrosis involving the entire femoral head. Sixty percent of the height of the lateral column is resorbed. There is no lateral subluxation or physeal disturbance. The range of abduction is 30Â°. Recommended treatment consists of:

1) Observation
3) Femoral osteotomy
2) Atlanta Scottish Rite orthosis
5) Petrie cast
4) Iliac osteotomy

The young age is the overwhelmingly positive factor in this patient. None of the findings mandate a more vigorous approach than observation.

- The Atlanta Scottish Rite orthosis has not been proven to have any effect on the disorder.
- Femoral osteotomy would only be possibly indicated, if there were subluxation greater than 25%.
- Iliac osteotomy would only be indicated in this age group, if there were subluxation and/or other poor prognostic factors.
- Petrie cast is indicated only if the patient has subluxation.

Correct Answer: Observation

1764. (598) Q5-836:

A 13-year-old girl has hip pain and the inability to bear weight. On anteroposterior and lateral hip radiographs the femoral head is displaced inferiorly and posteriorly by 50% of its diameter. Recommended treatment includes:

1) Closed reduction and immobilization in a spica cast
3) Open reduction and pin fixation
2) Traction followed by internal fixation
5) In situ fixation with screw(s)
4) Metaphyseal osteotomy and internal fixation

In situ fixation has results superior to any of the other methods.

- Besides being extremely cumbersome, spica cast treatment carries significant risk of redisplacement and chondrolysis.
- There is no indication for traction in this situation.
- The amount of displacement can be accepted as long as it is stabilized.
- Metaphyseal osteotomy carries a risk of avascular necrosis. It should only be undertaken in grade III slips.

Correct Answer: In situ fixation with screw(s)

1765. (599) Q5-837:

A 12-year-old boy is brought to the emergency department with posterior left pelvic pain, a limp, a temperature of 101Â° F, and a white blood count of 15,000. C-reactive protein is 55. Magnetic resonance imaging shows increased signal within the posterior ilium on T2 weighted images, but no fluid is outside the bone. Recommended treatment includes:

1) Obtaining a percutaneous bone biopsy
3) Oral dicloxacillin
2) Irrigation and debridement
5) Intravenous oxacillin and gentamicin
4) Intravenous oxacillin

Staphylococcal osteomyelitis is the presumptive diagnosis; therefore, intravenous oxacillin should be administered.

- Infection is much more likely than tumor. The predicted organisms should be sensitive to oxacillin. A bone biopsy is not mandatory unless the patient fails to respond to intravenous antibiotics.
- Debridement is not likely to be necessary given no evidence of a sequestrum.
- Although acute hematogenous osteomyelitis is the likely diagnosis, it is standard practice to begin treatment with intravenous antibiotics and then switch to oral antibiotics when a clinical response is evident.
- Gentamicin is not needed in this setting.

Correct Answer: Intravenous oxacillin

1766. (600) Q5-838:

A newborn infant in the nursery must be seen because of his foot. The dorsum of the foot rests against the tibia. The heel moves up when the forefoot moves down. Power is present in all muscles. The foot has an arch and the leg lengths are equal. The diagnosis is:

1) Fibular hemimelia
3) Calcaneovalgus foot
2) Vertical talus
5) Lipomeningocele
4) Tethered cord

Calcaneovalgus foot has all of these findings and resolves spontaneously.

- Fibular hemimelia typically has less calcaneus attitude and more valgus and shortening.
- Vertical talus entails loss of an arch and loss of cohesive movement of the foot as a whole.
- There is no evidence of muscle weakness.
- There is no evidence of a neuropathic component.

Correct Answer: Calcaneovalgus foot

1767. (601) Q5-839:

A newborn girl is noted to have decreased movement in the right upper extremity. She was large (10 lbs) at birth and was delivered vaginally with shoulder dystocia. She does not have elbow flexion, external shoulder rotation, or abduction. She has had weak finger flexion for 3 months. At 4-months-old, she regains the ability to flex her elbow. Recommended treatment includes:

1) Magnetic resonance imaging of the shoulder
3) Physical therapy
2) Tendon transfers of the teres major and latissimus
5) Open reduction of the glenohumeral joint
4) Microvascular repair of the brachial plexus

Conservative therapy is predicted to bring a good result because biceps are returning at four months of age. However, stretching of the shoulder is indicated to maintain a range of external rotation and abduction.

- Magnetic resonance imaging is only indicated if there is a need to consider microvascular repair.
- Tendon transfers are performed later (at several years of age), if shoulder abduction and external rotation are significantly limited.
- Microvascular repair is mainly considered in patients who do not have return of biceps function by five months.
- Open reduction is indicated later (if the shoulder joint is subluxated or severely contracted) after motor recovery has reached a plateau.

Correct Answer: Physical therapy

1768. (602) Q5-840:

A 7-year-old boy with diplegic cerebral palsy has had lengthening of his hamstrings and heelcords. He is examined 2 years later. He walks with the knees nearly straight throughout the gait cycle and circumducts each extremity during swing. This pattern is most likely due to:

1) Recurrent hamstring tightness
3) Spasticity of the rectus femoris
2) Overlengthening of the heelcords
5) Spasticity of the psoas muscle
4) Contracture of the tensor fascia lata

The straight legs and circumduction suggest spasticity of the rectus femoris as the most likely cause.

- Recurrent hamstring tightness (by itself) would cause the opposite combination of problems.
- Overlengthening of the heelcords usually causes increased dorsiflexion at the ankles and would help to increase the flexion moment rather than the extension.
- Contracture of the tensor fascia lata is extremely rare in cerebral palsy.
- Spasticity in the psoas muscle would not lead to a stiff knee gait.

Correct Answer: Spasticity of the rectus femoris

1769. (603) Q5-841:

A 3-year-old girl is brought in for evaluation of leg alignment. She has bilateral foot progression angles of 35Â° internal. Her thigh-foot angles are 40Â° internal. Her hip rotation in the prone position is 50Â° external and 30Â° internal. The metaphyseal-diaphyseal angle is 2Â° on each side. Recommended treatment includes:

1) Denis Browne bar with feet 45Â° outward
3) Femoral derotation osteotomy
2) Bilateral double-upright knee-ankle-foot orthoses
5) Observation
4) Tibial osteotomy

The tibial torsion described has an excellent chance of resolution over time. Observation is indicated.

- This child has tibial torsion. The Denis Browne bar has not been proven to affect the natural history of tibial torsion.
- The knee-ankle-foot orthoses are used for genu varum, which is not the primary problem in this case.
- A femoral osteotomy is rarely used to correct femoral anteversion in older children.
- A tibial osteotomy is rarely used to correct tibial torsion in older children.

Correct Answer: Observation

1770. (604) Q5-842:

A newborn baby has a foot that is dorsiflexed and in valgus. The differential diagnosis includes all of the following conditions except:

1) Calcaneovalgus foot
3) Muscle imbalance from an L5 myelomeningocele
2) Vertical talus
5) Tibial hemimelia
4) Posteromedial bow of the tibia

The foot in a patient with tibial hemimelia does not resemble the other four conditions described; the foot is in equinus and varus.

- Calcaneovalgus foot is dorsiflexed and everted through the axis of the ankle joint.
- A vertical talus has excessive forefoot dorsiflexion and valgus.
- A patient with an L5 myelomeningocele may have this appearance due to activity of the dorsiflexors and evertors, with absent power in the plantarflexors and invertors.
- Due to the posteromedial bow in the tibia, the foot may appear dorsiflexed and in valgus.

Correct Answer: Tibial hemimelia

1771. (605) Q5-843:

A 6-year-old girl with osteogenesis imperfecta has severe bowing of both femurs. The family is interested in surgery to correct the condition. This method will give her the longest interval between procedures in the future:

1) Closed osteoclasis and cast application
3) Multiple osteotomies and realignment over parallel rods
2) Multiple osteotomies and realignment over a single smooth rod
5) Excision of the abnormal bone and replacement with allograft
4) Multiple osteotomies and realignment over telescoping rods

Telescoping or Bailey-Dubow rods are able to grow with the patient and maintain stabilization for a mean of 4 years between operations in growing children.

- Without the addition of internal fixation, bowing is likely to resume.
- Although a single rod is likely to provide current stability, bowing is likely to occur as the patient grows and the bone becomes longer than the rod.
- Parallel rods do not interlock and are likely to splay and lose fixation.
- There are no reports of large segment allograft replacement for diaphyses in osteogenesis imperfecta. In the absence of internal fixation, bowing is likely to resume as growth occurs.

Correct Answer: Multiple osteotomies and realignment over telescoping rods

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1772. (606) Q5-844:

An infant is seen in the office for the first time. She has slender, stiff fingers with few creases, elbow range of motion 20Â° to 45Â°, and internally rotated arms. Her legs are flexed and externally rotated at the hip. Knee range of motion is 15Â° to 40Â° of flexion, and she has bilateral clubfeet that are stiff. The most likely diagnosis is:

1) Larsen syndrome
3) Ehlers-Danlos syndrome
2) Cerebral palsy
5) Arthrogryposis
4) Down syndrome

The patient has enough joint contractures to make arthrogryposis a likely diagnosis.

- Larsen syndrome is characterized by dislocation of multiple joints.
- Cerebral palsy is characterized by spasticity and flexors overpowering extensors.
- Ehlers-Danlos is characterized by hyperlaxity of the large joints.
- Down syndrome does not present with stiffness.

Correct Answer: Arthrogryposis

1773. (607) Q5-845:

Which of the following statements best characterizes the natural history of metatarsus adductus in a newborn:

1) Metatarsus adductus is likely to become fixed if not treated with casts.
3) Metatarsus adductus is likely to become fixed if not surgically corrected.
2) Metatarsus adductus is likely to become fixed if not treated by 6 months.
5) Most infants will improve spontaneously.
4) Metatarsus adductus is likely to later develop hindfoot equinus.

Virtually all patients with metatarsus adductus will improve with time in the absence of active treatment.

- Casts are not needed for the majority of cases because spontaneous improvement is by far the most common outcome.
- Reverse last shoes are not needed in the majority of patients with metatarsus adductus.
- Most patients will not need surgery.
- Equinus of the hindfoot is not part of the pathology in metatarsus adductus.

Correct Answer: Most infants will improve spontaneously.

1774. (608) Q5-846:

A 2Â½-year-old boy has severe spastic diplegia and hips that are subluxating. His abduction is 20Â° on each side. The migration index is 35% on each side. Recommended treatment includes:

1) Traction followed by bilateral Salter osteotomy
3) Nighttime abduction splinting
2) Trochanteric transfer
5) Physical therapy each day to stretch abductors along with night
4) Bilateral adductor lengthening and abduction bracing

If followed by postoperative bracing, lengthening of the adductors is usually successful in children younger than 4 to 6 years of age.

- Traction would not be appropriate because the muscles are spastic. The surgical plan does not include the most important component â weakening the overactive adductors.
- Trochanteric transfer is not advisable in patients younger than 8 years old. Trochanteric transfer would not help decrease the overpull of the adductors which is the cause of the subluxation.
- Nighttime abduction splinting should be a component of the care after surgery. Bracing alone would not be an adequate treatment.
- Physical therapy in the absence of surgery does not seem to be enough to overcome the pull of the adductors.

Correct Answer: Bilateral adductor lengthening and abduction bracing

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1775. (609) Q5-847:

A 15-year-old boy has a Salter type-2 fracture of the distal tibia. His foot is in valgus and external rotation. Recommended treatment is:

1) Obtaining computed tomograms of the fracture
3) Closed reduction and immobilization in a long leg cast
2) Obtaining a magnetic resonance imaging study of the ankle
5) Open reduction and internal fixation
4) Closed reduction and percutaneous fixation of the fracture

There is a good chance that a satisfactory closed reduction may be achieved by correcting the valgus and external rotation.

- The fracture should first be reduced. There is a good chance of a satisfactory reduction. The patient is old enough that a significant physeal growth disorder is not likely.
- Magnetic resonance imaging is not indicated unless there is a question of physeal disorder after healing or an entrapped fragment.

Correct Answer: Closed reduction and immobilization in a long leg cast

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1776. (610) Q5-848:

Adolescent girls with multiple radiographs for idiopathic scoliosis are statistically at increased risk for which of the following problems later in life:

1) Lung cancer
3) Lymphoma
2) Breast cancer
5) Squamous carcinoma
4) Leukemia

In a historical cohort study, the risk was increased to 1.7 times the expected rate of breast cancer. The radiation dose is currently lower. The exposure to the breast may be lowered by taking posteroanterior rather than anteroposterior films, and eliminating lateral films in routine situations.

Correct Answer: Breast cancer

1777. (611) Q5-849:

The mean amount of growth height occurring in each vertbra per year during later childhood and early adolescence is:

1) 0.7 mm
3) 2.9 mm
2) 2 mm
5) 6 mm
4) 4 mm

The mean growth is 0.7 mm per vertebra per year. This measurement is averaged across all of the thoracic and lumbar vertebrae.

Correct Answer: 0.7 mm

1778. (612) Q5-850:

Which of the following features is true of congenital scoliosis but not infantile idiopathic scoliosis:

1) Bracing has been shown to decrease progression.
3) The thoracic curve may be convex to either the left side or the right in either curve type.
2) The age of onset is before 3 years old.
5) Vertebrae are abnormally formed from birth.
4) The rib-vertebral angle difference predicts the risk of worsening.

In congenital scoliosis, the vertebrae are abnormally formed from birth. The vertebrae are normal at birth in infantile idiopathic scoliosis.

- Age of onset is before age 3 in both types of scoliosis.
- The thoracic curve may be convex to the left slide or the right side in either curve type. In infantile idiopathic scoliosis, it is most commonly convex to the left.
- The rib-vertebral angle difference (angle between the apical vertebral endplate and the rib on the convexity minus the rib on the concavity) greater than 20Â° predicts an increased risk of worsening in infantile idiopathic scoliosis but not in congenital scoliosis.
- Bracing has not been shown to affect infantile idiopathic scoliosis.

Correct Answer: Vertebrae are abnormally formed from birth.

1779. (613) Q5-851:

A 12-year-old child with sickle cell anemia has had pain in the distal femur for 1 day, a temperature of 101.5Â° F, and a white blood count of 14,000/mm^3. Plain films are unremarkable. Recommended treatment includes:

1) Magnetic resonance imaging of the area
3) Needle biopsy of the distal femur
2) Bone scan
5) Intravenous hydration and analgesia
4) Indium labeled white cell scan

Because the odds are greatly in favor of a noninfectious process, it is appropriate to treat empirically with rehydration and analgesia.

- Magnetic resonance imaging would not distinguish between infection and vaso-occlusive crisis.
- Bone scan would not distinguish between infection and vaso-occlusive crisis.
- Needle biopsy is not necessary at this stage since the odds are high (greater than 95%) that the process is not infection.
- White blood cell scan is not able to distinguish between infection and vaso-occlusive crisis.

Correct Answer: Intravenous hydration and analgesia

1780. (614) Q5-852:

A 6-year-old girl is wearing a seatbelt but no shoulder harness when the car she is occupying strikes another car. She suffers an abdominal contusion as well as a spine injury. The facets of L1 and L2 are spread apart as is the disk between them. The angle between the two vertebrae is 35Â°. The neurologic exam is within normal limits. Recommended treatment includes:

1) Reduction and immobilization in a hyperextension cast
3) Traction for 3 weeks followed by an orthosis
2) Reduction and immobilization in a plastic orthosis
5) Open reduction, in situ fusion, and cast immobilization
4) Open reduction, instrumentation, and fusion L1-L2

Open reduction and 2-level fusion is the simplest way of handling this injury.

- Immobilization in a hyperextension cast is likely to exacerbate the abdominal injury.
- An orthosis is not likely to reduce the deformity.
- Traction would not be a good mechanism to reduce the deformity.
- In situ fusion would be insufficient without instrumentation.

Correct Answer: Open reduction, instrumentation, and fusion L1-L2

1781. (650) Q5-893:

Secondary ossification of the elbow

1) Occurs over a two-year period
3) Proceeds in a predictable fashion through skeletal maturity
2) Occurs more rapidly in males
5) Is complete by age 10
4) Is not important for the orthopedist to understand

Secondary ossification is very imprtant in managing fractures. It begins at age 1-2 and is complete by 14 years girls and 16 years in boys.Correct Answer: Proceeds in a predictable fashion through skeletal maturity

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1782. (651) Q5-894:

Definitive diagnosis of septic arthritis is made by:

1) Magnetic resonance imaging
3) Needle aspiration
2) Plain radiographs
5) Serologic testing
4) Open biopsy

Definitive diagnoisis of septic arthritis is made by needle asperation.Correct Answer: Needle aspiration

1783. (652) Q5-895:

Osteomyelitis in the child

1) requires operative debridement in the majority of cases.
3) never causes growth disturbance of the involved bone.
2) requires antibiotic therapy for 3 to 6 weeks.
5) Always crosses the physis in children
4) occurs in the diaphysis in most cases.

Osteomyelitis in the child requires 3-6 weeks of antiobiotics which may be administered parenterally or internally.Correct Answer: requires antibiotic therapy for 3 to 6 weeks.

1784. (4039) Q5-896:

All of the following characterize lateral patellar compression syndrome except:

1) Anterior knee pain localized to the patellofemoral joint
3) Subluxation of the patella
2) A tight lateral retinaculum
5) May be unilateral or bilateral
4) A lateral patella tilt with narrowing of the lateral patella and femoral articular surfaces on the sunrise radiograph

By definition, patients with a lateral patellar compression syndrome do not have a subluxation or dislocation of the patella.Correct Answer: Subluxation of the patella

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1785. (653) Q5-898:

Osteochondral defects occur bilaterally in the distal femur in approximately:

1) 10% to 20% of patients.
3) 30% to 40% of patients.
2) 20% to 30% of patients.
5) 80% to 90% of patients
4) 60% to 70% of patients.

Osteochondral defects occur bilaterally in the distal femur for approximately 20% to 30% of patients. The fact that 20% to 30% of patients with an osteochondral lesion in the distal femur have bilateral involvement suggests that there is a predisposition to the development of a lesion at this location, either genetic or secondary to repetitive microtrauma.Correct Answer: 20% to 30% of patients.

1786. (654) Q5-899:

The magnetic resonance imaging signs that suggest instability of an osteochondral dissecans lesion include all the following except:

1) The presence of a low signal intensity line at the interface between the lesion and the underlying bone.
3) Focal cartilaginous defects.
2) Cartilaginous fractures.
5) Fluid signal between lesion and bone
4) Cysts underlying the osteochondritis dissecans lesion.

The presence of a high signal intensity line at the interface between the lesion and the underlying bone suggests instability of an osteochondritis dissecans lesion.Correct Answer: The presence of a low signal intensity line at the interface between the lesion and the underlying bone.

1787. (655) Q5-903:

The neonatal hand:

1) Has no primary ossification centers visible at birth.
3) Ossifies the carpus from the margins, centrally.
2) Demonstrates secondary ossification centers from proximal to distal.
4) Is proportionately different from the mature hand.

The neonatal hand is proportionally different from the mature hand.Correct Answer: Is proportionately different from the mature hand.

1788. (656) Q5-904:

Pediatric bone:

1) Has a higher modulus of elasticity than adult bone.
3) Has a short plastic phase on the load-deformation curve.
2) Has lower bending strength than adult bone.
5) Is more mineralized than adult bone
4) Has periosteum, which is more prone to tear than adult periosteum.

Pediatric bone has less mineral and more vascular channels than adult bone. This gives it a lower bending strength and lower modules of elasticity than adult bone.Correct Answer: Has lower bending strength than adult bone.

1789. (657) Q5-905:

In congenital lesions characterized by failure of formation of parts, the most functional, without treatment, is/are:

1) Transverse arrest at the wrist.
3) VATER syndrome.
2) Central deficiencies.
5) Radial deficiencies
4) Ulnar deficiencies.

Central deficiencies allow a wide grasp, good release and pinch. These are also termed "cleft hand". The other conditions produce greater impairment.Correct Answer: Central deficiencies.

1790. (658) Q5-906:

Which category of failure of formation anomalies is most often associated with systemic anomalies?

1) Radial deficiencies.
3) Central deficiencies.
2) Ulnar deficiencies.
5) Tibial deficiencies
4) Transverse deficiencies.

Radial deficiencies are often seen in the later association. which may include cardiac,renal,anorectal and tracheoesphogeal abnormalities.Correct Answer: Radial deficiencies.

1791. (659) Q5-910:

Arthrogryposis multiplex congenita:

1) Primarily affects joints, and secondarily the muscles which move them.
3) Is typically asymmetrical.
2) Is more often neuropathic than myopathic.
5) Has a natural history of increasing joint range of motion with time
4) Does not respond to passive joint mobilization.

Arthrogryposis multiplex congenita is an idiopathic disorder that may be due to a primary deficiency of anterior horn cells. Arthrogryposis multiplex congenita results in lack of muscle development; the joint stiffness is secondary to this. It is usually reasonably symmetrical.Correct Answer: Is more often neuropathic than myopathic.

1792. (677) Q5-936:

What percentage of the human genome represents the actual genes:

1) 80%
3) 50%
2) 66%
5) 5%
4) 20%

The percentage of the genome that represents the sequence of our genes is approximately 5%. The rest of the genome codes are for initiator and termination sequences, maintenance functions, and unknown functions.

Correct Answer: 5%

1793. (678) Q5-937:

In studying a newly recognized disorder using a large population of affected individuals, geneticists discover that although the disorder often affects siblings, it was rarely, if ever, detected in their ancestors. This disorder most closely follows which pattern of inheritance:

1) Autosomal dominant
3) Sex-linked
2) Autosomal recessive
5) Anticipation
4) Multifactorial

Autosomal recessive conditions classically show âhorizontalâ inheritance. Ancestors do not display the gene because they would likely have only one copy of the mutant allele. Only when two carriers reproduce is the phenotype manifest in approximately one-fourth of their offspring.

- Autosomal dominant inheritance is characterized by vertical transmission. Many generations manifest the trait because it takes only a single copy of a mutant allele to display the phenotype.
- Sex-linked conditions are often traced back in a family. Normally the males are affected and the females are carriers.
- Multifactorial conditions are thought to result from the combination of different genes. Although the risk of recurrence in kindred is somewhat greater than the population as a whole, it is still quite low (only a few percent). It is rare for siblings to be affected.
- Anticipation refers to the phenomenon in which successive generations are likely to display more severe forms of a given disorder. Myotonic dystrophy is a classic example of this phenomenon.

Correct Answer: Autosomal recessive

1794. (679) Q5-938:

Diseases caused by enzyme deficiency are commonly inherited by which of the following patterns:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Non-mendelian
4) Multifactorial

Two copies of a mutant allele are required to reduce enzyme function to levels that cause clinical impairment.

- Enzyme defects are rarely inherited by an autosomal dominant pattern because even half of the normal activity of most enzymes is adequate to maintain normal function.
- Enzyme defects are rarely inherited in an X-linked dominant pattern because one copy of a mutant allele is usually sufficient.
- Multifactorial inheritance refers to the interaction of multiple, or different genes, to produce a disorder. Enzyme deficiencies are typically the result of a defect in a single gene.
- Because enzymes are typically coded by a single gene, they follow mendelian patterns.

Correct Answer: Autosomal recessive

1795. (680) Q5-939:

Morquio syndrome is caused by a deficiency in:

1) Alpha-L-iduronidase
3) Beta-glucuronidase
2) Galactose-6-sulfatase
5) Sulfate transport protein
4) Fibroblast growth factor receptor protein

Morquio syndrome is a member of the family of mucopolysaccharidoses. Morquio syndrome is a deficiency in the enzyme galactose-6-sulfatase. A deficiency in galactose-6-sulfatase results in increased urinary excretion of keratosulfate.

- Alpha-L-iduronidase is deficient in Hurler syndrome.
- Beta-glucuronidase is deficient in some rare mucopolysaccharidoses.
- Fibroblast growth factor receptor protein is deficient in achondroplasia.
- Sulfate transport protein is deficient in diastrophic dysplasia.

Correct Answer: Galactose-6-sulfatase

1796. (681) Q5-940:

Polymerase chain reaction (PCR) is best characterized by which of the following descriptions:

1) Use of enzymes to link chains of deoxyribonucleic acid (DNA) together
3) Denaturing and reannealing DNA multiple times with known primers
2) Use of viral vectors to insert new DNA into a cell
5) The process by which a cell-surface receptor turns on the transcription process
4) Use of high temperatures to create ultra-high molecular weight polyethylene

Polymerase chain reaction refers to denaturing DNA, isolating a segment of interest with known primers, and reannealing the strands multiple times to produce exponential copies of a segment.

Correct Answer: Denaturing and reannealing DNA multiple times with known primers

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1797. (682) Q5-941:

Pleiotropy is demonstrated by which of the following examples:

1) Patients with osteogenesis imperfecta differ in the number of fractures they have received.
3) Hurler syndrome is usually not present in prior generations of an affected patient.
2) Patients with hemophilia A have different target joints.
5) Patients with Ollier disease often have more involvement on one side of the body.
4) Some patients with Marfan syndrome have scoliosis or pectus carinatum, while other patients with Marfan syndrome do not.

The term pleiotropy refers to a disease taking different shapes in various patients.

- Variation in the severity of a given problem is better termed "variable expressivity."
- Target joints are not genetically determined.
- Hurler syndrome usually not being present in prior generations of an affected patient is an example of autosomal recessive inheritance.
- The term pleiotropy refers to a disease taking different shapes in different subjects, whereas the cause of patients with Ollier disease having more involvement on one side of the body is unknown.

Correct Answer: Some patients with Marfan syndrome have scoliosis or pectus carinatum, while other patients with Marfan syndrome do not.

1798. (683) Q5-942:

Which of the following is the most common concern regarding anesthesia for a patient with juvenile rheumatoid arthritis:

1) Basilar invagination
3) Subaxial subluxation
2) Rotatory subluxation of C1-C2
5) Cervical stenosis
4) Small, stiff jaw

Stiffness and mandibular hypoplasia are fairly common in juvenile rheumatoid arthritis (JRA) due to inflammation of the temporomandibular joint that affects the growth plates of the mandibles.

- Basilar invagination is rare in JRA.
- Rotatory subluxation of C1-C2 is rare in JRA.
- Subaxial subluxation is rare in JRA.
- Cervical stenosis is not a clinical problem in JRA.

Correct Answer: Small, stiff jaw

1799. (684) Q5-943:

A 4-year-old boy is brought to a clinic because he has been fussy, febrile, and unable to bend over for the past 4 days. In the office, his temperature is 38.2Â° C and his neurologic examination is normal. His lumbar lordosis is flattened and he resists flexion or extension. He has normal range of hip motion. Plain films of the lumbar spine are normal. The next imaging study should be:

1) Magnetic resonance imaging of the spine
3) Spinal ultrasound
2) Hip arthrogram
5) Indium labeled white blood cell scan
4) Computed tomograms of the lumbar spine

Magnetic resonance imaging should be the next step to rule out pyogenic spondylitis.

- Ultrasound has not been proven effective in evaluation of anterior spinal pathology.
- Computed tomograms do not have a greater sensitivity than plain films in early diagnosis of infection.
- An indium labeled scan may yield diagnostic information but would not be the preferred test because of the time needed and inability to provide other diagnostic information.
- Hip arthrogram would not be the next step because the hip range of motion is normal. Even if hip pathology were suspected, the next step would be a plain film and an ultrasound.

Correct Answer: Magnetic resonance imaging of the spine

1800. (685) Q5-944:

A 6-year-old child suffers a displaced fracture of the distal humerus in the supracondylar region. Neurologic and vascular exams are normal. The surgeon decides to reduce and pin the fracture. Which of the following risks increases if the procedure is delayed more than 8 hours?

1) Brachial artery damage
3) Radial nerve palsy
2) Median nerve palsy
5) No risks increase
4) Need for an open reduction

A retrospective comparison study has shown no increase of risks in delayed treatment of supracondylar fractures.

Correct Answer: No risks increase

1801. (686) Q5-945:

Which of the following statements is true regarding the growth plates around the ankle:

1) The distal fibula grows more than the distal tibia.
3) The anterolateral portion of the tibial physis ceases growing first.
2) The distal tibia grows more than the distal fibula.
5) The two growth plates are part of a common physis.
4) The two physes should be at an even level.

The distal tibia grows more than the distal fibula.

- The anterolateral portion of the tibial physis ceases growing last, thus explaining the phenomenon of the Tillaux fracture.
- The physis of the distal fibula is always located more distally than the distal tibia.
- The two physes are not conjoined.

Correct Answer: The distal tibia grows more than the distal fibula.

1802. (687) Q5-946:

Which of the following is the most common final attribution of back pain in children and adolescents after all appropriate diagnostic studies are performed:

1) Spondylolysis
3) Infection
2) Osteoid osteoma
5) No identifiable cause
4) Herniated nucleus pulposus

The majority of children and adolescents do not have an identifiable cause of back pain after all appropriate tests are performed. Of the smaller percent of patients with an actual diagnosis, spondylolysis followed by herniated nucleus pulposus are most common.

Correct Answer: No identifiable cause

1803. (688) Q5-947:

Which of the following is the most definitive means of making a diagnosis of active skeletal tuberculosis:

1) Positive tuberculin tine test
3) Positive culture and histological exam
2) Negative tuberculin tine test
5) Enzyme linked immunosorbent assay (ELISA) test
4) Magnetic resonance imaging

The lower thoracic-upper lumbar spine is most commonly affected by tuberculosis. The most definitive diagnosis is by culture and histologic examination.

Correct Answer: Positive culture and histological exam

1804. (689) Q5-948:

Which of the following descriptions is more characteristic of tuberculosis than of pyogenic spondylitis:

1) Disc space is narrowed before significant bony changes occur.
3) Bony erosions seen on computerized tomography are usually small and focal.
2) Involvement of multiple contiguous levels is uncommon.
5) Magnetic resonance imaging rarely shows significant soft tissue swelling.
4) Vertebral destruction exceeds disc destruction.

Vertebral destruction exceeds disc destruction in tuberculosis.

- Bony changes occur earlier in tuberculosis than in pyogenic spondylitis.
- Involvement of multiple contiguous levels is more common in tuberculosis than pyogenic spondylitis.
- Bony erosions seen on computerized tomography are large in tuberclosis and small in pyogenic spondylitis.
- Magnetic resonance imaging often shows significant soft tissue involvement in both disorders.

Correct Answer: Vertebral destruction exceeds disc destruction.

1805. (690) Q5-949:

A 5-year-old girl comes into the clinic with back pain. Her family has just moved to the United States from southeastern Asia. A lateral radiograph shows destruction of T11, T12, and L1. Magnetic resonance imaging shows a moderate posterior soft tissue mass. A neurological exam is normal. Biopsy confirms tuberculosis. For treatment of the girlâs spinal problem, recommended treatment includes:

1) A two-drug therapy for at least 6 months
3) A two-drug therapy and posterior spinal fusion to prevent deformity
2) A two-drug therapy for at least 6 months along with a body cast
5) Anterior debridement, strut graft, and posterior fusion with instrumentation
4) Anterior spinal debridement and a rib strut graft

Anterior debridement, strut graft, and posterior fusion with instrumentation provide the patient with the best chance of a positive result. This procedure minimizes graft dislodgement and posterior overgrowth.

- A two-drug therapy for at least 6 months leaves the patient at a significant risk of progressive kyphosis and neurologic deficit.
- A two-drug therapy for at least 6 months along with a body cast also leaves the patient with significant risk of progressive kyphosis and neurologic deficit.
- The lack of anterior support from a two-drug therapy and posterior spinal fusion to prevent deformity leaves the patient with significant risk of kyphosis.
- Even with an anterior spinal debridement and a rib strut graft, there is a risk of graft dislodgment over this large defect and of posterior growth into kyphosis.

Correct Answer: Anterior debridement, strut graft, and posterior fusion with instrumentation

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1806. (691) Q5-950:

A dorsal approach has which of the following characteristics with regard to a posteromedial approach in the surgical treatment of congenital vertical talus:

1) The dorsal approach requires a more extensive dissection.
3) The dorsal approach requires plication of the talonavicular capsule.
2) The dorsal approach has a lower risk of avascular necrosis of the talus.
5) The dorsal approach requires a longer tourniquet time.
4) The dorsal approach has a higher risk of redislocation.

The dorsal approach has not shown evidence of avascular necrosis, whereas the posteromedial approach has shown such changes at follow-up in as many as 40% of cases.

- The dorsal approach requires a less extensive dissection than the posteromedial approach.
- The dorsal approach does not require or permit plication of the talonavicular capsule, whereas the posteromedial approach does.
- The dorsal approach does not appear to have a higher rate of redislocation of the talonavicular joint than the posteromedial approach.
- The dorsal approach requires a shorter tourniquet time than the posteromedial approach.

Correct Answer: The dorsal approach has a lower risk of avascular necrosis of the talus.

1807. (692) Q5-951:

Which of the following conditions is not associated with an increased risk of congenital vertical talus?

1) Sacral agenesis
3) Myelomeningocele
2) Cerebral palsy
5) Nail patella syndrome
4) ArthrogryposisV

Patients with cerebral palsy do not have an increased risk of congenital vertical talus, but they may develop an acquired neuromuscular vertical talus.

- Patients with myelomeningocele have approximately a 5% to 10% risk of vertical talus, far above that of the general population.
- Arthrogryposis is associated with an increased risk of vertical talus.
- Nail patella syndrome is associated with an increased risk of vertical talus.
- Sacral agenesis is associated with an increased risk of vertical talus.

Correct Answer: Cerebral palsy

1808. (693) Q5-953:

Scoliosis in Marfan syndrome, as compared to idiopathic scoliosis, is characterized by which of the following:

1) Scoliosis curves are more likely to begin in the juvenile period.
3) Brace treatment is more likely to be successful because of the flexibility.
2) There is an increased likelihood of left thoracic curves.
5) Curves are more likely to be stable in adulthood.
4) Patients are less likely to have back pain.

Scoliosis curves are much more likely to begin in the juvenile period than idiopathic scoliosis.

- There is no significant difference in the likelihood of left thoracic curves in Marfan syndrome.
- Brace treatment is less likely to be successful in Marfan syndrome than in idiopathic scoliosis.
- Marfan patients with scoliosis are more likely to have back pain.
- Marfan curves are more likely to progress in adulthood.

Correct Answer: Scoliosis curves are more likely to begin in the juvenile period.

1809. (694) Q5-954:

Which of the following statements is true of demineralized bone matrix:

1) Demineralized bone matrix is weakly osteoinductive.
3) Demineralized bone matrix is not osteoconductive.
2) Demineralized bone matrix is consistent between forms and different sterilization methods.
5) Demineralized bone matrix is strongly osteoinductive.
4) Demineralized bone matrix is osteogenic.

Demineralized bone matrix is weakly osteoinductive.

- The term osteogenic refers to direct transmittal of cells capable of making bone. Demineralized bone matrix is not osteogenic.
- Demineralized bone matrix varies in efficacy between different forms and different methods of sterilization.
- The term osteoconduction refers to provision of a favorable scaffold and environment for bone formation.
- Demineralized bone matrix is osteoconductive.

Correct Answer: Demineralized bone matrix is weakly osteoinductive.

1810. (695) Q5-955:

A 16-year-old boy with type I Ehlers-Danlos syndrome has a spinal curvature that has progressed 18Â° in the past year. The curve is a double major type with a Cobb angle of 60Â° in each curve. There is no associated kyphosis. The following treatment is recommend:

1) Observation
3) Anterior fusion and instrumentation
2) Bracing
5) Anterior and posterior fusion with instrumentation
4) Posterior fusion and instrumentation

Posterior fusion and instrumentation is the best-documented treatment. Although this form of treatment is followed by an increased incidence of wound healing problems, the problems can be treated.

- Observation is not recommended because the curve is highly likely to increase and cause a decrease in pulmonary function.
- Bracing has no role in large curves, and it is not known if bracing is successful at all in Ehlers-Danlos syndrome.
- Anterior fusion with instrumentation would be difficult with a double curve. Anterior fusion carries an increased risk due to vascular fragility. It is not necessary because there is no increased risk of crankshaft or pseudarthrosis.
- There is no particular reason for adding an anterior procedure in this situation in view of the vascular risk.

Correct Answer: Posterior fusion and instrumentation

1811. (696) Q5-956:

Scoliosis in osteogenesis imperfecta is characterized by which of the following:

1) Scoliosis which is due primarily to vertebral fractures.
3) Scoliosis is due primarily to associated neurologic problems.
2) Scoliosis is due primarily to ligamentous laxity.
5) Scoliosis rarely impairs quality of life.
4) Scoliosis usually responds to brace treatment.

Scoliosis in osteogenesis imperfecta (OI) is due primarily to ligamentous laxity.

- Scoliosis in OI is due primarily to ligamentous laxity, not bony fractures.
- There is no association between brainstem impression and scoliosis.
- Scoliosis in OI rarely responds to brace treatment.
- Scoliosis, when present in OI, is a major impairment of quality of life.

Correct Answer: Scoliosis is due primarily to ligamentous laxity.

1812. (697) Q5-957:

Which of the following is not a specific feature in making the diagnosis of a dystrophic curve in neurofibromatosis 1:

1) Penciling of the ribs
3) Widening of the foramen
2) Scalloping of the vertebrae
5) Vertebral rotation
4) Thinning of the transverse processes

Vertebral rotation is not a specific characteristic of dystrophic curves. Rotation is more pronounced in dystrophic curves than in nondystrophic curves, but it is commonly present in both types of curves.

- Penciling of the ribs is one of the features specific for dystrophic curves in neurofibromatosis 1.
- Scalloping of the vertebrae anteriorly and posteriorly is characteristic of dystrophic curves in neurofibromatosis 1.
- Widening of the neural foramen is specific for dystrophic curves in neurofibromatosis 1. Widening of the neural foramen is due to tumorous masses passing through the foramen.
- Thinning of the transverse process is a characteristic of dystrophic curves in neurofibromatosis 1.

Correct Answer: Vertebral rotation

1813. (698) Q5-958:

The spine in familial dysautonomia is characterized by which of the following:

1) Rare scoliosis
3) Dense bone
2) Flexible scoliosis
5) Spinal stenosis
4) Increased risk of loss of fixation after surgery

There is an increased risk of loss of fixation in familial dysautonomia curves due to decreased bone density and curve rigidity.

- Scoliosis is common in patients with familial dysautonomia and affects up to one-half of patients with the disorder.
- The curves in familial dysautonomia are rigid, leading to limited correction.
- The bone density in familial dysautonomia is decreased.
- Spinal stenosis is not reported in patients with familial dysautonomia.

Correct Answer: Increased risk of loss of fixation after surgery

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1814. (699) Q5-959:

Which of the following problems is most common in achondroplasia:

1) Atlantoaxial instability
3) Symptomatic kyphosis
2) Basilar invagination
5) Spondylolisthesis
4) Thoracolumbar stenosis

Symptomatic stenosis of the thoracic and lumbar spine is seen in almost half of all achondroplastic patients, although not all patients require surgery.

- Atlantoaxial instability is rare in achondroplasia, although it is not uncommon in other dysplasias.
- Basilar invagination is not present in achondroplasia.
- Kyphosis is often transient in achondroplasia and rarely persists beyond the second year. Kyphosis is rarely symptomatic.
- Spondylolisthesis is rare in achondroplasia.

Correct Answer: Thoracolumbar stenosis

1815. (700) Q5-960:

A 2-year-old girl with diastrophic dysplasia is brought into the office for an overall examination. A lateral radiograph of the spine shows a kyphosis of 35Â° from C3 to C6. A neurologic exam is normal, although she does have stiff joints. The patient is not yet walking. For management of this kyphosis, recommended treatment includes:

1) Observation
3) Halo traction
2) Cervicothoracic orthosis
5) Anterior and posterior fusion
4) Posterior fusion

Many of these kyphoses will correct spontaneously if the curve does not exceed 50Â°. In this patient, the inability to walk is most likely due to other skeletal factors.

- There is no evidence that orthosis will change the natural history of the disorder.
- There is no need for traction given the high chance of spontaneous resolution and the dangers of traction.
- Posterior fusion is only indicated if the kyphosis is continually progressive, or if neurologic signs or symptoms develop.
- Anterior and posterior surgery is only indicated in cases with severe pre-existing neurologic deficit.

Correct Answer: Observation

1816. (701) Q5-962:

A baby born with diastrophic dysplasia today may eventually require all of the following orthopedic procedures during childhood or adulthood except:

1) Correction of equinus or varus feet
3) Posterior spinal fusion for scoliosis
2) Arthrodesis from the occiput to the atlas or axis
5) Arthroplasty of the knees
4) Arthroplasty of the hips

Patients with diastrophic dysplasia rarely have instability of the upper cervical spine.

- Babies with diastrophic dysplasia often have rigid equinovarus feet that require surgery to become plantigrade and wear normal shoes.
- A number of patients with diastrophic dysplasia develop progressive scoliosis that requires surgical treatment.
- Degenerative disease of the hips is common and often requires arthroplasty in early adulthood.
- Degenerative disease of the knees is common and often requires arthroplasty in early adulthood.

Correct Answer: Arthrodesis from the occiput to the atlas or axis

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1817. (702) Q5-963:

A patient with spondyloepiphyseal dysplasia congenita reaches the age of 5 without being able to walk with a walker. She has five beats of clonus in both ankles. Her reflexes are brisk and her toes are upgoing. The most likely problem that accounts for these conditions is:

1) Severe scoliosis of the thoracic spine
3) Lumbar stenosis
2) Foramen magnum stenosis
5) Atlantoaxial instability
4) Thoracolumbar kyphosis

Atlantoaxial instability, sometimes combined with stenosis of the atlas, is a frequent cause of myelopathy in spondyloepiphyseal dysplasia congenita.

- Scoliosis does not account for developmental delay or myelopathy.
- Foramen magnum stenosis is rare in spondyloepiphyseal dysplasia congenita.
- Lumbar stenosis is rare with spondyloepiphyseal dysplasia congenita and would not account for myelopathy.
- Thoracolumbar kyphosis severe enough to cause myelopathy is rare in spondyloepiphyseal dysplasia congenita condition.

Correct Answer: Atlantoaxial instability

1818. (703) Q5-964:

Scoliosis in cleidocranial dysplasia is frequently associated with which of the following conditions:

1) Syringomyelia
3) Spondylolisthesis
2) Atlantoaxial instability
5) Spinal decompensation
4) Spinal stenosis

Scoliosis with cleidocranial dysplasia (CCD) is frequently associated with syringomyelia.

- Cervical instability is rare in CCD.
- Spondylolisthesis is rare in CCD.
- Spinal stenosis is rare in CCD.
- Spinal decompensation is rare in CCD.

Correct Answer: Syringomyelia

1819. (704) Q5-965:

A 3-year-old girl with Larsen syndrome is brought into the office for examination. A spinal radiograph demonstrates a 50Â° kyphosis of the cervical spine. Her neurologic examination is normal. Recommended treatment includes:

1) Observation
3) Cervical-thoracic orthosis
2) Halo traction
5) Anterior and posterior fusion
4) Posterior cervical fusion

Posterior cervical fusion has been proven effective in curves of 60Â°or less, in preventing progression, and allowing correction with anterior growth.

- This curve is much more likely to worsen than to spontaneously improve, so preventive surgery is indicated.
- There is no role for halo traction in this situation.
- Bracing has not been proven effective in helping patients with Larsen syndrome.
- Addition of anterior fusion is not needed for this degree of curve in a neurologically normal child.

Correct Answer: Posterior cervical fusion

1820. (705) Q5-966:

A 10-year-old patient with Hurler syndrome has undergone a bone marrow transplant and is currently medically stable. He has developed a painful thoracolumbar kyphosis that measures 50Â° with 25% subluxation T12 on L1. Recommended treatment includes which of the following:

1) Exercise program for the trunk extensor muscles
3) Halo traction followed by orthosis
2) Thoracolumbar orthosis
5) Anterior and posterior spinal fusion
4) Posterior spinal fusion

Anterior and posterior fusion will correct the translation, instability, and ensure a solid fusion.

- Exercises will not correct the subluxation, which is the cause of the pain.
- A thoracolumbar orthosis is not corrective or well tolerated.
- There is no need for halo traction.
- Posterior fusion alone is not enough to control this focal instability if the patient is well enough to tolerate a more involved procedure.

Correct Answer: Anterior and posterior spinal fusion

1821. (706) Q5-967:

Aneurysmal bone cyst of the spine is most common in which of the following regions:

1) Cervical
3) Lower thoracic
2) Upper thoracic
5) Sacral
4) Lumbar

Aneurysmal bone cyst of the spine is most common in the lumbar spine, followed by the cervical spine. Aneurysmal bone cyst of the spine is treated with embolization and/or surgical resection and reconstruction.

Correct Answer: Lumbar

1822. (707) Q5-968:

Aneurysmal bone cyst of the spine is most likely in this age group:

1) First decade
3) Third decade
2) Second decade
5) Fifth decade
4) Fourth decade

The most common age is the second decade; the mean age is 13 years old.

Correct Answer: Second decade

1823. (708) Q5-969:

A 14-year-old girl is examined because of a pain in her left flank. The radiographs of the lumbar spine show loss of the pedicle with expansion of the lateral wall of the third lumbar vertebral body. Magnetic resonance imaging shows multiple fluid levels in the vertebral body with no additional areas of involvement. She is neurologically normal. The least invasive, effective treatment is which?

1) Observation
3) Selective arterial embolization
2) Radiation therapy
5) Curettage plus radiation therapy
4) Radical en bloc resection

This patient has an aneurysmal bone cyst of the vertebra. Selective arterial embolization is a minimally invasive treatment that often succeeds in arresting the lesions. Many times it is the only treatment needed. Selective arterial embolization can also be used as part of a strategy to be followed by curettage and reconstruction to decrease operative bleeding.

- This lesion will continue to expand and might cause neurologic compromise or mechanical instability.
- Radiation therapy poses risks of later malignant degeneration. There are other ways of treating this lesion.
- Radical en bloc resection may unnecessarily injure neurologic structures.
- While curettage is often necessary, there is no reason to introduce the risk of radiation therapy.

Correct Answer: Selective arterial embolization

1824. (709) Q5-970:

A 15-year-old girl has severe hip pain 3 years after a slipped capital femoral epiphysis that was complicated by avascular necrosis. Recommended treatment is a hip arthrodesis. In response to questions about late effects, after surgery the patient should be told that she is most likely to experience:

1) Low back pain
3) Pain in the contralateral hip
2) Marked limitation of activity
5) Significant continued limp
4) Continued severe pain in the ipsilateral hip

Low back pain, followed closely by ipsilateral knee pain, is the most common late effect of hip arthrodesis in young patients. The tolerable pain usually occurs much later but may be treated by conversion to arthroplasty, if needed.

- Ipsilateral hip pain should be minimal or absent if the fusion is successful.
- Activity following arthrodesis is not significantly limited. Sports and heavy physical activities are feasible.
- The limp is usually minimal because the loss of hip motion is masked by lumbar motion.
- Pain in the contralateral hip is rare and is often minimal after hip arthrodesis.

Correct Answer: Low back pain

1825. (710) Q5-971:

Which of the following is an appropriate position for arthrodesis of the hip in a young person:

1) Flexion of 45Â°
3) Adduction of 0Â°
2) Abduction of 15Â° if there is shortening
5) Shortening of at least 3 cm
4) External rotation of 25Â°

Neutral abduction is important in preventing back pain.

- The flexion should be between 25Â° and 35Â°.
- Any abduction beyond neutral poses increased risk of back pain.
- External rotation beyond approximately 5Â° is not needed.
- Arthrodesis often produces some shortening; therefore, intentional shortening is not needed.

Correct Answer: Adduction of 0Â°

1826. (711) Q5-972:

A 12-year-old girl is brought into the office for an examination because of hip pain. She is able to bear weight on the involved limb while using crutches for stability. Radiographs reveal a grade III slip of the capital femoral epiphysis. Recommended treatment for this patient is:

1) Skeletal femoral traction in order to improve the position
3) Osteotomy of the femoral neck to improve the alignment
2) Manipulate the hip under anesthesia in order to improve the position of the head
5) In situ fixation
4) Application of a hip spica

In situ fixation provides the best results no matter what the grade of slip.

Correct Answer: In situ fixation

1827. (712) Q5-973:

A 9-year-old boy with cerebral palsy has trouble sitting. His mother states that whenever his diapers are changed or his hips are moved, he begins to cry. Radiographs demonstrate high dislocations of both femoral heads. The femoral heads have an ovoid shape and superolateral flattening. Recommended treatment is:

1) Botulinum toxin injected into the adductors
3) Bilateral femoral osteotomies with acetabuloplasty
2) Bilateral open adductor tenotomy
5) Bilateral Colonna arthroplasty
4) Bilateral proximal femoral resection

Bilateral proximal femoral resection is the recommended treatment.

- Femoral head dislocations may become painful in cerebral palsy at a much earlier age than in nonspastic individuals.
- Botulinum toxin or adductor tenotomy will not solve the problem.
- Replacing the deformed femoral heads into the acetabulum will not achieve the long-term goal of good hip range of motion.

Correct Answer: Bilateral proximal femoral resection

1828. (713) Q5-974:

A 9-year-old boy is examined due to a closed distal forearm fracture. The radius and ulna are both fractured and translated 100%. After manipulation twice with sedation, the translation cannot be reduced. There is 10-mm shortening of the radius and 5-mm shortening of the ulna. The distal radial angulation on the anteroposterior view is 5Â° less than normal. The least invasive treatment which would produce acceptable results is:

1) Closed reduction in the operating room under general anesthesia
3) Open reduction and percutaneous pin fixation
2) Open reduction and cast application
5) Acceptance of the reduction and maintenance with a cast
4) Open reduction and plate fixation

The translation and shortening are not problems and the amount of angulation will easily remodel with this fracture. There is nothing to be gained from operative reduction.

Correct Answer: Acceptance of the reduction and maintenance with a cast

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1829. (714) Q5-975:

When applying a halo for postoperative immobilization in a skeletally mature teenager, which of the following is the proper torque for the pins:

1) 2 inch-pounds
3) 8 inch-pounds
2) 4 inch-pounds
5) 12 inch-pounds
4) 10 inch-pounds

This patient should be treated like an adult. Eight inch-pounds is the currently recommended torque to provide optimal biomechanical fixation while minimizing pin penetration.

Correct Answer: 8 inch-pounds

1830. (715) Q5-976:

A posterior spine fusion with segmental hook fixation from T4-L4 is performed for idiopathic scoliosis in a 15-year-old girl. Somatosensory evoked potential monitoring is normal throughout the procedure. The patient awakens and is unable to move either lower extremity, but she does have some sensation in the lower extremities. Recommended treatment includes:

1) Removal of instrumentation
3) Laminectomy above the conus medullaris
2) Myelogram
5) Full heparinization of the patient
4) Administration of corticosteroids and observation for 6 hours

Spinal cord injury occurs in approximately 1% of patients operated upon for idiopathic scoliosis. In some cases, sensory spinal cord monitoring may be unchanged, especially if the injury preserves the dorsal columns. The instrumentation should be removed as soon as possible in case spinal traction or derotation or implant protrusion is producing effects on the cord or its blood supply.

- Corticosteroids should be administered at spinal cord injury doses, but this should not be the only measure.
- Obtaining a myelogram may delay the removal of instrumentation and should not be the first step.
- Heparinization has no proven effect.

Correct Answer: Removal of instrumentation

1831. (716) Q5-977:

A 12-year-old boy with achondroplasia has a gradual 40Â° thoracolumbar kyphosis. He is unable to walk more than two blocks. Magnetic resonance imaging reveals spinal stenosis, and the patient is scheduled to undergo posterior decompression from T12-S1. In addition to this procedure, you recommend:

1) Observation with serial radiographs every 4 months
3) In situ fusion with bone graft
2) Postoperative brace for 6 months
5) Anterior corpectomy and fusion of T12
4) Posterior fusion across the kyphosis with instrumentation

Extensive posterior decompression poses a high risk of postoperative increase in kyphosis because of both the patientâs age and pre-existing kyphosis.

- Observation would not be a good idea because the risk is already known to be high.
- Neither a brace nor an uninstrumented fusion would prevent the deformity from developing.
- Corpectomy is not indicated because the kyphosis is not focal.
- Posterior instrumented fusion at the time of decompression is indicated.

Correct Answer: Posterior fusion across the kyphosis with instrumentation

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1832. (717) Q5-978:

Which of the following is true regarding brace treatment for Scheuermann kyphosis:

1) The Milwaukee brace is not indicated.
3) Bracing is effective in curves over 75Â°.
2) Permanent improvement is usually obtainable if compliant.
5) The brace should be worn for 1 year after starting brace treatment.
4) Bracing is ineffective in curves having an apex at or above T8.

Brace treatment is effective for Scheuermann kyphosis. Unlike idiopathic scoliosis, permanent improvement of the deformity is the goal.

- The Milwaukee brace is often indicated.
- Brace treatment is ineffective for curves over 74Â°.
- The brace should be worn until skeletal maturity.

Correct Answer: Permanent improvement is usually obtainable if compliant.

1833. (718) Q5-979:

Which of the following statements is true about bone marrow transplantation in mucopolysaccharidoses:

1) Bone marrow transplantation is contraindicated.
3) Bone marrow transplantation reverses the orthopedic manifestations.
2) Bone marrow transplantation does not affect the orthopedic problems.
5) Bone marrow transplantation should be deferred until skeletal maturity.
4) Graft-versus-host disease is rare.

Bone marrow transplantation is effective in minimizing the deposition of mucopolysaccharides in solid organs. Transplantation should be done early to prevent organ damage. Because the lysosomal enzyme does not cross the cell membrane of osteocartilaginous cells, it does not affect the orthopedic aspects. The risk of graft-versus-host disease is high but may be treated in most cases. Survival rate is 61% at 2 years for Hurler disease, which is otherwise fatal before maturity.

Correct Answer: Bone marrow transplantation does not affect the orthopedic problems.

1834. (796) Q5-1057:

A 7-year-old boy is brought in for an examination due to back pain. He has limited forward bending. Neurologic examination is normal. Radiographs reveal a uniform flattening of the third lumbar vertebra to 10% of its normal height. His temperature is 37.1Â° C and his white blood count is 11,000. The erythrocyte sedimentation rate is 18. The most likely diagnosis is:

1) Osteogenesis imperfecta
3) Tuberculosis
2) Eosinophilic granuloma
5) Compression fracture
4) Bacterial infection

Eosinophilic granuloma often produces complete flattening of a single vertebral body in the absence of trauma or neurologic deficit.

- Osteogenesis imperfecta produces a more uniform flattening of the vertebrae but not by this degree.
- Tuberculosis rarely produces this much flattening of a single vertebra. The erythrocyte sedimentation rate is elevated in this condition.
- Bacterial infection rarely produces this much flattening of a single vertebral body without associated disk changes. The lab studies should suggest an inflammatory process.
- Compression fracture produces less complete flattening of the vertebral bodies.

Correct Answer: Eosinophilic granuloma

1835. (797) Q5-1058:

A 12-year-old patient with osteogenic sarcoma metastatic to the spine is noted to have new onset of weakness of both lower extremities. Magnetic resonance imaging shows a mass expanding posteriorly and encroaching on the spinal cord. The recommended initial step is:

1) Radiation therapy and steroids
3) Surgical resection
2) Increasing the dose of chemotherapy
5) Observation only
4) Steroids and observation alone

Radiation therapy combined with steroids should be tried first to try to halt progression of the tumor. Unfortunately, the prognosis for this child is extremely poor.

- Increasing the dose of chemotherapy is not likely to work because the metastasis has already progressed despite initial treatment.
- Surgical resection must be tried if radiation does not produce improvement.
- Steroids are an adjunct to treatment but not sufficient alone.
- The patient is likely to have progressive paraparesis and loss of bowel function. In order to improve the quality of life remaining, surgical resection should be offered to the patient.

Correct Answer: Radiation therapy and steroids

1836. (798) Q5-1059:

The primary purpose of osteotomy in the closure of classic exstrophy of the bladder is to:

1) Decrease the tension on the closure of the abdominal wall and bladder
3) Prevent degenerative disease of the hip
2) Decrease the strain on the sacroiliac joints
5) Allow reconstruction of a normal symphysis pubis
4) Normalize the gait

The primary purpose of osteotomy is to improve the chance of a successful urologic reconstruction. This is achieved by decreasing the tension on the closure of the abdominal wall and bladder.

- The strain on the sacroiliac joints has not been measured with or without closure; this is not a primary purpose of the osteotomy.
- There is no conclusive evidence that the hips are at increased risk of degenerative disease in patients with exstrophy, or that osteotomy will alter the condition.
- In patients with exstrophy, the gait progressively normalizes over time.
- It is not possible to reconstruct a normal symphysis pubis in exstrophy.

Correct Answer: Decrease the tension on the closure of the abdominal wall and bladder

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1837. (799) Q5-1060:

Which of the following is not a common finding in cloacal exstrophy:

1) Omphalocele
3) Hydrocephalus
2) Spinal dysrhaphism
5) Dislocation of the hip(s)
4) Dysplasia of the sacroiliac joints

Hydrocephalus is rare because most patients have lipomeningocele, not myelomeningocele.

- Omphalocele is common in cloacal exstrophy.
- Most patients with cloacal exstrophy have a lipomeningocele that is a form of spinal dysrhaphism.
- Many patients have malformations of the sacroiliac joints.
- Approximately 25% of patients have dislocations of at least one hip.

Correct Answer: Hydrocephalus

1838. (800) Q5-1061:

The thickness of a flexible intramedullary nail used in pediatric femur fractures should be which of the following percentages of the diameter of the femoral isthmus:

1) 10%
3) 40%
2) 25%
5) 75%
4) 50%

It is recommended that the intramedullary nail be 40% of the diameter of the femoral isthmus.

Correct Answer: 40%

1839. (801) Q5-1062:

An infant is born with fibular hemimelia and has 20% shortening of the involved below-knee segment. Four rays are present on the foot, and the ankle is in slight valgus. Limb lengthening is likely to be superior to Syme disarticulation in which of the following parameters:

1) Pain
3) Psychological acceptance
2) Function
5) Prosthetic costs
4) Number of procedures

The cost of prosthetics is greater in the disarticulation group.

- Pain is greater in the lengthened group.
- Function is equal to or better in the group who had disarticulation.
- Psychological acceptance is greater in the disarticulation group.
- The lengthened group requires more than twice the number of procedures.

Correct Answer: Prosthetic costs

1840. (802) Q5-1063:

Which of the following is the best discriminator for risk of nonaccidental (child abuse) injury in young children with femoral shaft fractures:

1) Pattern of the fracture
3) Socioeconomic class
2) Level of the fracture on the femur
5) Coexisting disability in the child
4) Ability to walk

Nonaccidental injury was a factor in 29% of patients who were unable to walk vs 3% for patients who were able to walk.

- The fracture pattern and level of fracture do not help determine nonaccidental injury.
- Socioeconomic class is not the best discriminator and, generally, should not be factored into the decision process.
- Coexisting disability is not a significant discriminator.

Correct Answer: Ability to walk

1841. (803) Q5-1064:

A 12-year-old boy with hemophilia A has a painless mass in his thigh. The femur is eroded anterolaterally and there is a large overlying soft tissue mass. Magnetic resonance imaging shows a 5 cm x 7 cm mass arising from the bone. The most likely diagnosis is:

1) Telangiectatic osteosarcoma
3) Infection
2) Aneurysmal bone cyst
5) Lymphangioma
4) Pseudotumor

A pseudotumor is a hemophilic subperiosteal hematoma. The pseudotumor expands by repeated bleeds and increasing osmotic pressure.

- There was no periosteal reaction or intralesional calcification.
- The bone wall itself is not expanded as in aneurysmal bone cyst.
- There is nothing in the physical examination or patient history to point to infection.

Correct Answer: Pseudotumor

1842. (804) Q5-1065:

In classic hemophilia, a natural factor-VIII level of less than what percentage will lead to severe bleeding and complications:

1) 50%
3) 15%
2) 25%
5) 5%
4) 10%

A surprisingly small amount of circulating factor-VIII (approximately 5%) is necessary to protect a patient from severe bleeding complications.

Correct Answer: 5%

1843. (805) Q5-1066:

A 1-week-old female infant with arthrogryposis multiplex congenital has hips that are stiff in flexion and abduction, and her knees have a range of flexion from 20Â° to 40Â°. In addition, her right thigh has become swollen and tender. The most likely cause of this latter problem is:

1) Osteomyelitis of the femur
3) Dislocation of the hip
2) Septic arthritis of the hip
5) Fracture of the femur
4) Deep vein thrombosis

Fracture is common in this condition because of osteopenia and the stress concentration due to joint stiffness.

- Osteomyelitis is uncommon in the diaphysis and much less common in this scenario than fracture.
- Septic arthritis of the hip is uncommon in this disease.
- Dislocation of the hip would not cause pain and swelling in this setting.
- Deep vein thrombosis is uncommon at this age.

Correct Answer: Fracture of the femur

1844. (806) Q5-1067:

Which of the following is a true statement regarding the results of surgery for a contracted joint in arthrogryposis:

1) The joint range of motion can easily be doubled.
3) The beginning and end of the range may change, but the total amount of motion remains about the same.
2) The joint cannot be changed.
5) There is not an indication for such surgery.
4) The joint usually becomes stiffer.

The beginning and end of the range may change, but the total amount of motion remains about the same.

- The amount of the range cannot be significantly increased.
- The endpoint can change, but not the amount of the range.
- The joint does not usually become stiffer.
- There may be an indication for surgery to put the joints in a functional position.

Correct Answer: The beginning and end of the range may change, but the total amount of motion remains about the same.

1845. (807) Q5-1068:

Which of the following statements is true regarding scoliosis in cerebral palsy (CP):

1) Scoliosis is most common in hemiplegic CP because of muscle imbalance.
3) Scoliotic curves over 50Â° are likely to worsen even if the children are mature.
2) A thoracolumbosacral orthosis is usually successful in halting curve progression.
5) The surgical complication rate is lower in CP than idiopathic scoliosis.
4) Surgery for scoliosis will prolong life expectancy.

Curves greater than 50Â° usually progress.

- Scoliosis is most common in totally involved CP patients. Scoliosis is rare in patients with hemiplegia.
- Braces rarely halt curves in CP.
- Surgery has no proven effect on prolonging life expectancy.
- The complication rate is higher in CP.

Correct Answer: Scoliotic curves over 50Â° are likely to worsen even if the children are mature.

1846. (808) Q5-1069:

A 12-year-old girl is referred because of a positive school scoliosis screen. She has a curve of 16Â° from T5 to T12, convex to the right. She incidentally also complains of mild back pain over the region of the curve several times per month. Neurologic examination is normal. Recommended treatment includes:

1) Magnetic resonance imaging
3) Treatment with a thoracolumbosacral orthosis
2) Technetium bone scintigraphy with SPECT
5) Home exercises and re-examination in follow-up
4) Computed tomography of the thoracic spine

Home exercises and re-examination in follow-up is the most appropriate treatment in view of lack of any worrisome features. If this child had severe pain or significant night pain, then further imaging studies would be warranted.

- The magnetic resonance imaging is not indicated in this situation.
- The bone scan has a low likelihood of being positive.
- Bracing is not indicated for the curve or the pain.
- Computer tomography is unlikely to demonstrate any pathology.

Correct Answer: Home exercises and re-examination in follow-up

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1847. (809) Q5-1070:

A 10-year-old boy undergoes biopsy of a spinal cord tumor through a laminectomy of C7-T2. The most likely complication of this procedure is:

1) Progressive cervicothoracic kyphosis
3) Progressive scoliosis
2) Progressive cervicothoracic lordosis
5) Progressive C7 radiculopathy
4) Degenerative disk disease

The removal of posterior restraints in the young and growing flexible spine usually leads to cervicothoracic kyphosis.

Correct Answer: Progressive cervicothoracic kyphosis

1848. (810) Q5-1071:

A patient with neurofibromatosis and a 55Â° scoliosis may be treated with a posterior fusion and instrumentation alone in which of the following situations:

1) He has a kyphosis of 75Â°.
3) He has a prior pseudarthrosis.
2) He is also undergoing multilevel laminectomy for tumor.
5) He has a bone age of 9.
4) He has a kyphosis of 35Â°.

He has a kyphosis of 35Â°.

- This degree of kyphosis increases the risk of pseudarthrosis with posterior fusion alone.
- The laminectomy increases the risk of pseudarthrosis.
- Anterior fusion should be added when there is a history of pseudarthrosis.
- A 9-year-old boy has a high risk of crankshift phenomenon with posterior fusion alone.

Correct Answer: He has a kyphosis of 35Â°.

1849. (811) Q5-1072:

Which of the following statements is true regarding school screening for scoliosis:

1) The American Academy of Orthopaedic Surgeons (AAOS) no longer recommends it.
3) The AAOS recommends screening boys and girls at age 9.
2) The AAOS recommends screening each year.
5) The AAOS recommends screening only boys at age 16.
4) The AAOS recommends screening boys and girls at age 11.

All children should be screened at age 11.

- The AAOS still recommends school screening for scoliosis.
- The AAOS recognizes that yearly screening is counterproductive.
- Screening at age 9 is too early..
- Screening at age 16 is too late.

Correct Answer: The AAOS recommends screening boys and girls at age 11.

1850. (812) Q5-1073:

Treatment of a patient with lumbar level myelomeningocele who has a vertical talus should consist of:

1) Observation only
3) Achilles tenotomy
2) Talectomy
5) Triple arthrodesis in a reduced position
4) Open reduction of the vertical talus

Open reduction of the vertical talus will most likely prevent problems.

- With observation only, the patient is likely to stand or walk and develop pressure problems.
- Talectomy will not produce the most usable foot.
- Achilles tenotomy will not produce significant correction by itself.
- Triple arthrodesis will concentrate stress and lead to ulcers.

Correct Answer: Open reduction of the vertical talus

1851. (813) Q5-1074:

What percentage of the human genome represents the actual genes:

1) 80%
3) 50%
2) 66%
5) 5%
4) 20%

The percentage of the genome that represents the sequence of our genes is approximately 5%. The rest of the genome codes are for initiator and termination sequences, maintenance functions, and unknown functions.

Correct Answer: 5%

1852. (814) Q5-1075:

In studying a newly recognized disorder using a large population of affected individuals, geneticists discover that although the disorder often affects siblings, it is rarely found in any of their ancestors. This disorder most closely follows which pattern of inheritance:

1) Autosomal dominant
3) Sex-linked
2) Autosomal recessive
5) Anticipation
4) Multifactorial

Autosomal recessive conditions classically show âhorizontalâ inheritance. Ancestors do not display the gene because they would likely have only one copy of the mutant allele. Only when two carriers reproduce is the phenotype manifest in approximately one-fourth of their offspring.

- Autosomal dominant inheritance is characterized by vertical transmission. Many generations manifest the trait because it takes only a single copy of a mutant allele to display the phenotype.
- Sex-linked conditions are often traced back in a family. Normally the males are affected and the females are carriers.
- Multifactorial conditions are thought to result from the combination of different genes. Although the risk of recurrence in kindred is somewhat greater than the population as a whole, it is still quite low (only a few percent). It is rare for siblings to be affected.
- Anticipation refers to the phenomenon in which successive generations are likely to display more severe forms of a given disorder. Myotonic dystrophy is a classic example of this phenomenon.

Correct Answer: Autosomal recessive

1853. (815) Q5-1076:

Diseases caused by enzyme deficiency are commonly inherited by which of the following patterns:

1) Autosomal dominant
3) X-linked dominant
2) Autosomal recessive
5) Non-mendelian
4) Multifactorial

Two copies of a mutant allele are required to reduce enzyme function to levels that cause clinical impairment.

- Enzyme defects are rarely inherited by an autosomal dominant pattern because even half of the normal activity of most enzymes is adequate to maintain normal function.
- Enzyme defects are rarely inherited in an X-linked dominant pattern because one copy of a mutant allele is usually sufficient.
- Multifactorial inheritance refers to the interaction of multiple, or different genes, to produce a disorder. Enzyme deficiencies are typically the result of a defect in a single gene.
- Because enzymes are typically coded by a single gene, they follow mendelian patterns.

Correct Answer: Autosomal recessive

1854. (816) Q5-1077:

Morquio syndrome is caused by a deficiency in:

1) Alpha-L-iduronidase
3) Beta-glucuronidase
2) Galactose-6-sulfatase
5) Sulfate transport protein
4) Fibroblast growth factor receptor protein

Morquio syndrome is a member of the family of mucopolysaccharidoses. Morquio syndrome is a deficiency in the enzyme galactose-6-sulfatase. A deficiency in galactose-6-sulfatase results in increased urinary excretion of keratosulfate.

- Alpha-L-iduronidase is deficient in Hurler syndrome.
- Beta-glucuronidase is deficient in some rare mucopolysaccharidoses.
- Fibroblast growth factor receptor protein is deficient in achondroplasia.
- Sulfate transport protein is deficient in diastrophic dysplasia.

Correct Answer: Galactose-6-sulfatase

1855. (817) Q5-1078:

Polymerase chain reaction (PCR) is best characterized by which of the following descriptions:

1) Use of enzymes to link chains of deoxyribonucleic acid (DNA) together
3) Denaturing and reannealing DNA multiple times with known primers
2) Use of viral vectors to insert new DNA into a cell
5) The process by which a cell-surface receptor turns on the transcription process
4) Use of high temperatures to create ultra-high molecular weight polyethylene

Polymerase chain reaction refers to denaturing DNA, isolating a segment of interest with known primers, and reannealing the strands multiple times to produce exponential copies of a segment.

Correct Answer: Denaturing and reannealing DNA multiple times with known primers

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1856. (818) Q5-1079:

Pleiotropy is demonstrated by which of the following examples:

1) Patients with osteogenesis imperfecta differ in the number of fractures they have received.
3) Hurler syndrome is usually not present in prior generations of an affected patient.
2) Patients with hemophilia A have different target joints.
5) Patients with Ollier disease often have more involvement on one side of the body.
4) Some patients with Marfan syndrome have scoliosis or pectus carinatum, while other patients with Marfan syndrome do not.

The term pleiotropy refers to a disease taking different shapes in various patients.

- Variation in the severity of a given problem is better termed "variable expressivity."
- Target joints are not genetically determined.
- Hurler syndrome usually not being present in prior generations of an affected patient is an example of autosomal recessive inheritance.
- The term pleiotropy refers to a disease taking different shapes in different subjects, whereas the cause of patients with Ollier disease having more involvement on one side of the body is unknown.

Correct Answer: Some patients with Marfan syndrome have scoliosis or pectus carinatum, while other patients with Marfan syndrome do not.

1857. (819) Q5-1080:

Which of the following is the most common concern regarding anesthesia for a patient with juvenile rheumatoid arthritis:

1) Basilar invagination
3) Subaxial subluxation
2) Rotatory subluxation of C1-C2
5) Cervical stenosis
4) Small, stiff jaw

Stiffness and mandibular hypoplasia are fairly common in juvenile rheumatoid arthritis (JRA) due to inflammation of the temporomandibular joint that affects the growth plates of the mandibles.

- Basilar invagination is rare in JRA.
- Rotatory subluxation of C1-C2 is rare in JRA.
- Subaxial subluxation is rare in JRA.
- Cervical stenosis is not a clinical problem in JRA.

Correct Answer: Small, stiff jaw

1858. (820) Q5-1081:

A 4-year-old boy is brought to a clinic because he has been fussy, febrile, and unable to bend over for the past 4 days. In the office, his temperature is 38.2Â° C and his neurologic examination is normal. His lumbar lordosis is flattened and he resists flexion or extension. He has normal range of hip motion. Plain films of the lumbar spine are normal. The next imaging study should be:

1) Magnetic resonance imaging of the spine
3) Spinal ultrasound
2) Hip arthrogram
5) Indium labeled white blood cell scan
4) Computed tomograms of the lumbar spine

Magnetic resonance imaging should be the next step to rule out pyogenic spondylitis.

- Ultrasound has not been proven effective in evaluation of anterior spinal pathology.
- Computed tomograms do not have a greater sensitivity than plain films in early diagnosis of infection.
- An indium labeled scan may yield diagnostic information but would not be the preferred test because of the time needed and inability to provide other diagnostic information.
- Hip arthrogram would not be the next step because the hip range of motion is normal. Even if hip pathology were suspected, the next step would be a plain film and an ultrasound.

Correct Answer: Magnetic resonance imaging of the spine

1859. (821) Q5-1082:

A 6-year-old child suffers a displaced fracture of the distal humerus in the supracondylar region. The surgeon decides to reduce and pin the fracture. Which of the following risks increases if the procedure is delayed more than 8 hours?

1) Brachial artery damage
3) Radial nerve palsy
2) Median nerve palsy
5) No risks increase
4) Need for an open reduction

A retrospective comparison study has shown no increase of risks in delayed treatment of supracondylar fractures as long as the neurovascular examination is within normal limits.

Correct Answer: No risks increase

1860. (822) Q5-1083:

Which of the following statements is true regarding the growth plates around the ankle:

1) The distal fibula grows more than the distal tibia.
3) The anterolateral portion of the tibial physis ceases growing first.
2) The distal tibia grows more than the distal fibula.
5) The two growth plates are part of a common physis.
4) The two physes should be at an even level.

The distal tibia grows more than the distal fibula.

- The anterolateral portion of the tibial physis ceases growing last, thus explaining the phenomenon of the Tillaux fracture.
- The physis of the distal fibula is always located more distally than the distal tibia.
- The two physes are not conjoined.

Correct Answer: The distal tibia grows more than the distal fibula.

1861. (823) Q5-1084:

Which of the following is the most common final attribution of back pain in children and adolescents after all appropriate diagnostic studies are performed:

1) Spondylolysis
3) Infection
2) Osteoid osteoma
5) No identifiable cause
4) Herniated nucleus pulposus

The majority of children and adolescents do not have an identifiable cause of back pain after all appropriate tests are performed. Many times the diagnosis is "musculo-ligamentous strain." the most common identified cause is spondylolysis.

Correct Answer: No identifiable cause

1862. (824) Q5-1085:

Which of the following is the most definitive means of making a diagnosis of active skeletal tuberculosis:

1) Positive tuberculin tine test
3) Positive culture and histological exam
2) Negative tuberculin tine test
5) Enzyme linked immunosorbent assay (ELISA) test
4) Magnetic resonance imaging

An early histology confirmed later by a culture is considered the definitive means of diagnosis for active skeletal tuberculsosis.

- The tuberculin tine tests do not indicate active disease, only exposure.
- Magnetic resonance imaging is not specific for a particular infectious organism.
- The enzyme linked immunosorbent assay (ELISA) test is used to diagnose Lyme disease.

Correct Answer: Positive culture and histological exam

1863. (825) Q5-1086:

The most common region of the spine affected by tuberculosis is:

1) Cervical
3) Lower thoracic-upper lumbar
2) Upper thoracic
5) Cacral
4) Lower lumbar

The lower thoracic-upper lumbar spine is most commonly affected by tuberculosis. Multiple vertebrae are often involved in tuberculosis spondylitis.

Correct Answer: Lower thoracic-upper lumbar

1864. (826) Q5-1087:

Which of the following descriptions is more characteristic of tuberculosis than pyogenic spondylitis:

1) Disc space is narrowed before significant bony changes occur.
3) Bony erosions seen on computerized tomography are usually small and focal.
2) Involvement of multiple contiguous levels is uncommon.
5) Magnetic resonance imaging rarely shows significant soft tissue swelling.
4) Vertebral destruction exceeds disc destruction.

Vertebral destruction exceeds disc destruction in tuberculosis.

- Bony changes occur earlier in tuberculosis than in pyogenic spondylitis.
- Involvement of multiple contiguous levels is more common in tuberculosis than pyogenic spondylitis.
- Bony erosions seen on computerized tomography are large in tuberclosis and small in pyogenic spondylitis.
- Magnetic resonance imaging often shows significant soft tissue involvement in both disorders.

Correct Answer: Vertebral destruction exceeds disc destruction.

1865. (827) Q5-1088:

A 5-year-old girl comes into the clinic with back pain. Her family has just moved to the United States from southeastern Asia. A lateral radiograph shows destruction of T11, T12, and L1. Magnetic resonance imaging shows a moderate posterior soft tissue mass. A neurological exam is normal. Biopsy confirms tuberculosis. For the girlâs spinal problem, recommended treatment includes:

1) A two-drug therapy for at least 6 months
3) A two-drug therapy and posterior spinal fusion to prevent deformity
2) A two-drug therapy for at least 6 months along with a body cast
5) Anterior debridement, strut graft, and posterior fusion with instrumentation
4) Anterior spinal debridement and a rib strut graft

Anterior debridement, strut graft, and posterior fusion with instrumentation provide the patient with the best chance of a positive result. This procedure minimizes graft dislodgement and posterior overgrowth.

- A two-drug therapy alone for at least 6 months leaves the patient at a significant risk of progressive kyphosis and neurologic deficit.
- A two-drug therapy for at least 6 months along with a body cast also leaves the patient with significant risk of progressive kyphosis and neurologic deficit.
- The lack of anterior support from a two-drug therapy and posterior spinal fusion to prevent deformity leaves the patient with significant risk of kyphosis.
- Even with an anterior spinal debridement and a rib strut graft, there is a risk of graft dislodgment over this large defect and of posterior growth into kyphosis.

Correct Answer: Anterior debridement, strut graft, and posterior fusion with instrumentation

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1866. (828) Q5-1089:

A dorsal approach has which of the following characteristics with regard to a posteromedial approach in the surgical treatment of congenital vertical talus:

1) The dorsal approach requires a more extensive dissection.
3) The dorsal approach requires plication of the talonavicular capsule.
2) The dorsal approach has a lower risk of avascular necrosis of the talus.
5) The dorsal approach requires a longer tourniquet time.
4) The dorsal approach has a higher risk of redislocation.

The dorsal approach has not shown evidence of avascular necrosis, whereas the posteromedial approach has shown such changes at follow-up in as many as 40% of cases.

- The dorsal approach requires a less extensive dissection than the posteromedial approach.
- The dorsal approach does not require or permit plication of the talonavicular capsule, whereas the posteromedial approach does.
- The dorsal approach does not appear to have a higher rate of redislocation of the talonavicular joint than the posteromedial approach.
- The dorsal approach requires a shorter tourniquet time than the posteromedial approach.

Correct Answer: The dorsal approach has a lower risk of avascular necrosis of the talus.

1867. (829) Q5-1090:

Which of the following conditions is not associated with an increased incidence of congenital vertical talus:

1) Cerebral palsy
3) Arthrogryposis
2) Myelomeningocele
5) Larsen syndrome
4) Nail patella syndrome

Patients with cerebral palsy do not have an increased risk of congenital vertical talus, but they may develop an acquired neuromuscular vertical talus.

- Patients with myelomeningocele have approximately a 5% to 10% risk of vertical talus, far above that of the general population.
- Arthrogryposis is associated with an increased risk of vertical talus.
- Nail patella syndrome and Larsen syndrome are associated with an increased risk of vertical talus.

Correct Answer: Cerebral palsy

1868. (830) Q5-1092:

Scoliosis in Marfan syndrome is characterized by which of the following:

1) Scoliosis curves are more likely to begin in the juvenile period.
3) Brace treatment is more likely to be successful because of the flexibility.
2) There is an increased likelihood of left thoracic curves.
5) Curves are more likely to be stable in adulthood.
4) Patients are less likely to have back pain.

Scoliosis curves are much more likely to begin in the juvenile period than idiopathic scoliosis.

- There is no significant difference in the likelihood of left thoracic curves in Marfan syndrome.
- Brace treatment is less likely to be successful in Marfan syndrome than in idiopathic scoliosis.
- Marfan patients with scoliosis are more likely to have back pain.
- Marfan curves are more likely to progress in adulthood.

Correct Answer: Scoliosis curves are more likely to begin in the juvenile period.

1869. (831) Q5-1093:

Which of the following statements is true of demineralized bone matrix:

1) Demineralized bone matrix is osteogenic.
3) Demineralized bone matrix is weakly osteoinductive.
2) Demineralized bone matrix is strongly osteoinductive.
5) Demineralized bone matrix is not osteoconductive.
4) Demineralized bone matrix is consistent between forms and different sterilization methods.

Demineralized bone matrix is weakly osteoinductive.

- The term osteogenic refers to direct transmittal of cells capable of making bone. Demineralized bone matrix is not osteogenic.
- Demineralized bone matrix varies in efficacy between different forms and different methods of sterilization.
- The term osteoconduction refers to provision of a favorable scaffold and environment for bone formation.
- Demineralized bone matrix is osteoconductive.

Correct Answer: Demineralized bone matrix is weakly osteoinductive.

1870. (832) Q5-1094:

A 16-year-old boy with type I Ehlers-Danlos syndrome has a spinal curvature that has progressed 18Â° in the past year. The curve is a double major type with a Cobb angle of 60Â° in each curve. There is no associated kyphosis. The following treatment is recommend:

1) Observation
3) Anterior fusion and instrumentation
2) Bracing
5) Anterior and posterior fusion with instrumentation
4) Posterior fusion and instrumentation

Posterior fusion and instrumentation is the best-documented treatment. Although this form of treatment is followed by an increased incidence of wound healing problems, the problems can be treated.

- Observation is not recommended because the curve is highly likely to increase and cause a decrease in pulmonary function.
- Bracing has no role in large curves, and it is not known if bracing is successful in Ehlers-Danlos syndrome.
- Anterior fusion with instrumentation would be difficult with a double curve. Anterior fusion carries an increased risk due to vascular fragility. It is not necessary because there is no increased risk of crankshaft or pseudarthrosis.
- There is no particular reason for adding an anterior procedure in this situation in view of the vascular risk.

Correct Answer: Posterior fusion and instrumentation

1871. (833) Q5-1095:

Scoliosis in osteogenesis imperfecta is characterized by which of the following:

1) Scoliosis is due primarily to vertebral fractures.
3) Scoliosis is due primarily to associated neurologic problems.
2) Scoliosis is due primarily to ligamentous laxity.
5) Scoliosis rarely impairs quality of life.
4) Scoliosis usually responds to brace treatment.

Scoliosis in osteogenesis imperfecta (OI) is due primarily to ligamentous laxity.

- Scoliosis in OI is due primarily to ligamentous laxity, not bony fractures.
- There is no association between brainstem impression and scoliosis.
- Scoliosis in OI rarely responds to brace treatment.
- Scoliosis, when present in OI, is a major impairment of quality of life.

Correct Answer: Scoliosis is due primarily to ligamentous laxity.

1872. (834) Q5-1096:

Which of the following is not a specific feature in making the diagnosis of a dystrophic curve in neurofibromatosis 1:

1) Penciling of the ribs
3) Widening of the foramen
2) Scalloping of the vertebrae
5) Right convex apex
4) Thinning of the transverse processes

Right convex apex is not a specific characteristic of dystrophic curves. It is more common in dystrophic curves than in nondystrophic curves, but it is commonly present in both types of curves.

- Penciling of the ribs is one of the features specific for dystrophic curves in neurofibromatosis 1.
- Scalloping of the vertebrae anteriorly and posteriorly is characteristic of dystrophic curves in neurofibromatosis 1.
- Widening of the neural foramen is specific for dystrophic curves in neurofibromatosis 1. Widening of the neural foramen is due to tumorous masses passing through the foramen.
- Thinning of the transverse process is a characteristic of dystrophic curves in neurofibromatosis 1.

Correct Answer: Right convex apex

1873. (835) Q5-1097:

The spine in familial dysautonomia is characterized by which of the following:

1) Rare scoliosis
3) Dense bone
2) Flexible scoliosis
5) Spinal stenosis
4) Increased risk of loss of fixation after surgery

There is an increased risk of loss of fixation in familial dysautonomia curves due to decreased bone density and curve rigidity.

- Scoliosis is common in patients with familial dysautonomia and affects up to one-half of patients with the disorder.
- The curves in familial dysautonomia are rigid, leading to limited correction.
- The bone density in familial dysautonomia is decreased.
- Spinal stenosis is not reported in patients with familial dysautonomia.

Correct Answer: Increased risk of loss of fixation after surgery

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1874. (836) Q5-1098:

Which of the following spinal problems is most common in achondroplasia:

1) Atlantoaxial instability
3) Symptomatic kyphosis
2) Basilar invagination
5) Spondylolisthesis
4) Thoracolumbar stenosis

Symptomatic stenosis of the thoracic and lumbar spine is seen in almost half of all achondroplastic patients, although not all patients require surgery.

- Atlantoaxial instability is rare in achondroplasia, although it is not uncommon in other dysplasias.
- Basilar invagination is not present in achondroplasia.
- Kyphosis is often transient in achondroplasia and rarely persists beyond the second year. Kyphosis is rarely symptomatic.
- Spondylolisthesis is rare in achondroplasia.

Correct Answer: Thoracolumbar stenosis

1875. (837) Q5-1099:

A 2-year-old girl with diastrophic dysplasia is brought into the office for an overall examination. A lateral radiograph of the spine shows a kyphosis of 35Â° from C3 to C6. A neurologic exam is normal, although she does have stiff joints. The patient is not yet walking. For management of this kyphosis, recommended treatment includes:

1) Observation
3) Halo traction
2) Cervicothoracic orthosis
5) Anterior and posterior fusion
4) Posterior fusion

Many diastrophic cervical kyphoses will correct spontaneously if the curve does not exceed 50Â°. In this patient, the lack of walking is most likely due to other skeletal factors.

- There is no evidence that orthosis will change the natural history of the disorder.
- There is no need for traction given the high chance of spontaneous resolution and the dangers of traction.
- Posterior fusion is only indicated if the kyphosis is continually progressive, or if neurologic signs or symptoms develop.
- Anterior and posterior surgery is only indicated in cases with severe pre-existing neurologic deficit.

Correct Answer: Observation

1876. (838) Q5-1100:

A baby born with diastrophic dysplasia today may eventually require all of the following orthopedic procedures during childhood or adulthood except:

1) Correction of equinus or varus feet
3) Posterior spinal fusion for scoliosis
2) Arthrodesis from the occiput to the atlas or axis
5) Arthroplasty of the knees
4) Arthroplasty of the hips

Patients with diastrophic dysplasia rarely have instability of the upper cervical spine.

- Babies with diastrophic dysplasia often have rigid equinovarus feet that require surgery to become plantigrade and wear normal shoes.
- A number of patients with diastrophic dysplasia develop progressive scoliosis that requires surgical treatment.
- Degenerative disease of the hips is common and often requires arthroplasty in early adulthood.
- Degenerative disease of the knees is common and often requires arthroplasty in early adulthood.

Correct Answer: Arthrodesis from the occiput to the atlas or axis

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1877. (839) Q5-1101:

A patient with spondyloepiphyseal dysplasia congenita reaches the age of 5 without being able to walk with a walker. She has five beats of clonus in both ankles. Her reflexes are brisk and her toes are upgoing. The most likely problem that accounts for these findings is:

1) Severe scoliosis of the thoracic spine
3) Lumbar stenosis
2) Foramen magnum stenosis
5) Atlantoaxial instability
4) Thoracolumbar kyphosis

Atlantoaxial instability, sometimes combined with stenosis of the atlas, is a frequent cause of myelopathy in spondyloepiphyseal dysplasia congenita.

- Scoliosis does not account for developmental delay or myelopathy.
- Foramen magnum stenosis is rare in spondyloepiphyseal dysplasia congenita.
- Lumbar stenosis is rare with spondyloepiphyseal dysplasia congenita and would not account for myelopathy.
- Thoracolumbar kyphosis severe enough to cause myelopathy is rare in spondyloepiphyseal dysplasia congenita condition.

Correct Answer: Atlantoaxial instability

1878. (840) Q5-1102:

Scoliosis in cleidocranial dysplasia is frequently associated with which of the following conditions:

1) Syringomyelia
3) Spondylolisthesis
2) Atlantoaxial instability
5) Spinal decompensation
4) Spinal stenosis

Scoliosis with cleidocranial dysplasia (CCD) is frequently associated with syringomyelia.

- Cervical instability is rare in CCD.
- Spondylolisthesis is rare in CCD.
- Spinal stenosis is rare in CCD.
- Spinal decompensation is rare in CCD.

Correct Answer: Syringomyelia

1879. (841) Q5-1103:

A 3-year-old girl with Larsen syndrome is brought into the office for examination. A spinal radiograph demonstrates a 50Â° kyphosis of the cervical spine. Her neurologic examination is normal. Recommended treatment includes:

1) Observation
3) Cervical-thoracic orthosis
2) Halo traction
5) Anterior and posterior fusion
4) Posterior cervical fusion

Posterior cervical fusion has been proven effective in curves of 60Â°or less in Larsen syndrome, in preventing progression, and allowing correction with anterior growth.

- This curve is much more likely to worsen than to spontaneously improve, so preventive surgery is indicated.
- There is no role for halo traction in this situation.
- Bracing has not been proven effective in helping patients with Larsen syndrome.
- Addition of anterior fusion is not needed for this degree of curve in a neurologically normal child.

Correct Answer: Posterior cervical fusion

1880. (842) Q5-1104:

A 10-year-old patient with Hurler syndrome has undergone a bone marrow transplant and is currently medically stable. He has developed a painful thoracolumbar kyphosis that measures 50Â° with 25% subluxation T12 on L1. Recommended treatment includes which of the following:

1) Exercise program for the trunk extensor muscles
3) Halo traction followed by orthosis
2) Thoracolumbar orthosis
5) Anterior and posterior spinal fusion
4) Anterior spinal fusion

Anterior and posterior fusion will correct the translation, instability, and ensure a solid fusion. In some cases, posterior fusion alone will suffice if pedicle fixation is good.

- Exercises will not correct the subluxation, which is the cause of the pain.
- A thoracolumbar orthosis is not corrective or well tolerated.
- There is no need for halo traction.
- Anterior fusion alone is not enough to control this focal instability if the patient is well enough to tolerate a more involved procedure.

Correct Answer: Anterior and posterior spinal fusion

1881. (843) Q5-1105:

Aneurysmal bone cyst of the spine is most common in which of the following regions:

1) Cervical
3) Lower thoracic
2) Upper thoracic
5) Sacral
4) Lumbar

Aneurysmal bone cyst of the spine is most common in the lumbar spine, followed by the cervical spine. Aneurysmal bone cyst most commonly involves the anterior elements but later may expand into the posterior elements.

Correct Answer: Lumbar

1882. (844) Q5-1106:

Aneurysmal bone cyst of the spine is most likely in this age group:

1) First decade
3) Third decade
2) Second decade
5) Fifth decade
4) Fourth decade

The most common age is the second decade; the mean age is 13 years old for patients with this disorder.

Correct Answer: Second decade

1883. (845) Q5-1107:

A 14-year-old girl is examined because of a pain in her left flank. The radiographs of the lumbar spine show loss of the pedicle with expansion of the lateral wall of the third lumbar vertebral body. Magnetic resonance imaging shows multiple fluid levels with no additional areas of involvement. She is neurologically normal. Recommended treatment includes:

1) Observation
3) Selective arterial embolization
2) Radiation therapy
5) Curettage plus radiation therapy
4) Radical en bloc resection

This patient has an aneurysmal bone cyst. Selective arterial embolization is a minimally invasive treatment that often succeeds in arresting the lesions. Many times it is the only treatment needed. Selective arterial embolization can also be used as part of a strategy to be followed by curettage and reconstruction to decrease operative bleeding.

- This lesion will continue to expand and might cause neurologic compromise or mechanical instability.
- Radiation therapy poses risks of later malignant degeneration. There are other ways of treating this lesion.
- Radical en bloc resection may unnecessarily injure neurologic structures.
- While curettage is often necessary, there is no reason to introduce the risk of radiation therapy.

Correct Answer: Selective arterial embolization

1884. (846) Q5-1108:

A 15-year-old girl has severe hip pain following slipped capital femoral epiphysis that was complicated by avascular necrosis. Recommended treatment is a hip arthrodesis. In response to questions about late effects, after surgery the patient should be told that she is most likely to experience:

1) Low back pain
3) Marked limitation of activity
2) Continued severe pain in the ipsilateral hip
5) Pain in the contralateral hip
4) Significant continued limp

Low back pain, followed closely by ipsilateral knee pain, is the most common late effect of hip arthrodesis in young patients. The tolerable pain usually occurs much later but may be treated by conversion to arthroplasty, if needed.

- Ipsilateral hip pain should be minimal or absent if the fusion is successful.
- Activity following arthrodesis is not significantly limited. Sports and heavy physical activities are feasible.
- The limp is usually minimal because the loss of hip motion is masked by lumbar motion.
- Pain in the contralateral hip is rare and is often minimal after hip arthrodesis.

Correct Answer: Low back pain

1885. (847) Q5-1109:

Which of the following is a parameter that should be used in positioning arthrodesis of the hip in a young person:

1) Flexion of 45Â°
3) Adduction of 0Â°
2) Abduction of 15Â° if there is shortening
5) Shortening of at least 3 cm
4) External rotation of 25Â°

Neutral abduction is important in preventing back pain.

- The flexion should be between 25Â° and 35Â°.
- Any abduction beyond neutral poses increases risk of back pain.
- External rotation beyond approximately 5Â° is not needed.
- Arthrodesis often produces some mandatory shortening; therefore, intentional shortening is not needed.

Correct Answer: Adduction of 0Â°

1886. (848) Q5-1111:

A 9-year-old boy with cerebral palsy has trouble sitting. His mother states that whenever his diapers are changed or his hips are moved, he begins to cry. Radiographs demonstrate high dislocations of both femoral heads. The femoral heads have an ovoid shape and superolateral flattening. Recommended treatment includes:

1) Botulinum toxin injected into the adductors
3) Bilateral femoral osteotomies with acetabuloplasty
2) Bilateral open adductor tenotomy
5) Bilateral Colonna arthroplasty
4) Bilateral proximal femoral resection

Bilateral proximal femoral resection is the recommended treatment.

- Femoral head dislocations may become painful in cerebral palsy at a much earlier age than in nonspastic individuals.
- Botulinum toxin or adductor tenotomy will not solve the problem.
- Replacing the deformed femoral heads into the acetabulum will not achieve the long-term goal of good hip range of motion.

Correct Answer: Bilateral proximal femoral resection

1887. (849) Q5-1112:

A 9-year-old boy is examined due to a closed distal forearm fracture. The radius and ulna are both fractured and translated 100%. After manipulation twice with sedation, the translation cannot be reduced. There is 10-mm shortening of the radius and 5-mm shortening of the ulna. The distal radial angulation on the anteroposterior view is 5Â° less than normal. The next step in treatment should include:

1) Closed reduction in the operating room under general anesthesia
3) Open reduction and percutaneous pin fixation
2) Open reduction and cast application
5) Acceptance of the reduction and maintenance with a cast
4) Open reduction and plate fixation

The translation and shortening are not problems and the amount of angulation will easily remodel with this fracture. There is nothing to be gained from operative reduction.

Correct Answer: Acceptance of the reduction and maintenance with a cast

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1888. (850) Q5-1113:

When applying a halo for postoperative immobilization in a skeletally mature teenager, which of the following is the proper torque for the pins:

1) 2 inch-pounds
3) 8 inch-pounds
2) 4 inch-pounds
5) 12 inch-pounds
4) 10 inch-pounds

Eight inch-pounds is the currently recommended torque to provide optimal biomechanical fixation while minimizing pin penetration. This is also recommended for adults. In young children, 4- to 6-inch-pounds are preferred.

Correct Answer: 8 inch-pounds

1889. (851) Q5-1114:

A posterior spine fusion with segmental hook fixation from T4-L4 is performed for idiopathic scoliosis in a 15-year-old girl. Somatosensory evoked potential monitoring is normal throughout the procedure. The patient awakens and is unable to move either lower extremity, but she does have some sensation in the lower extremities. Recommended treatment includes:

1) Removal of instrumentation
3) Laminectomy above the conus medullaris
2) Myelogram
5) Full heparinization of the patient
4) Administration of corticosteroids and observation for 6 hours

Spinal cord injury occurs in approximately 0.1% of patients operated upon for idiopathic scoliosis. In some cases, sensory spinal cord monitoring may be unchanged, especially if the injury preserves the dorsal columns. The instrumentation should be removed as soon as possible in case spinal traction or derotation or implant protrusion is producing effects on the cord or its blood supply.

- Corticosteroids should be administered at spinal cord injury doses, but this should not be the only measure.
- Obtaining a myelogram may delay the removal of instrumentation and should not be the first step.
- Heparinization has no proven effect.

Correct Answer: Removal of instrumentation

1890. (852) Q5-1115:

A 12-year-old boy with achondroplasia has a gradual 40Â° thoracolumbar kyphosis. He is unable to walk more than two blocks. Magnetic resonance imaging reveals spinal stenosis, and the patient is scheduled to undergo posterior decompression from T12-S1. In addition to this procedure, you recommend:

1) Observation with serial radiographs every 4 months
3) In situ fusion with bone graft
2) Postoperative brace for 6 months
5) Anterior corpectomy and fusion of T12
4) Posterior fusion across the kyphosis with instrumentation

Extensive posterior decompression poses a high risk of postoperative increase in kyphosis because of both the patientâs age and pre-existing kyphosis.

- Observation would not be a good idea because the risk is already known to be high.
- Neither a brace nor an uninstrumented fusion would prevent the deformity from developing.
- Corpectomy is not indicated because the kyphosis is not focal.
- Posterior instrumented fusion at the time of decompression is indicated.

Correct Answer: Posterior fusion across the kyphosis with instrumentation

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1891. (853) Q5-1116:

Which of the following is true regarding brace treatment for Scheuermann kyphosis:

1) The Milwaukee brace is not indicated.
3) Bracing is effective in curves over 75Â°.
2) Permanent correction is usually obtainable.
5) The brace should be worn for 1 year after starting brace treatment.
4) Bracing is ineffective in curves having an apex at or above T8.

Brace treatment is effective for Scheuermann kyphosis. Unlike idiopathic scoliosis, permanent correction of the deformity is the goal.

- The Milwaukee brace is often indicated.
- Brace treatment is ineffective for curves over 74Â°.
- The brace should be worn until skeletal maturity.

Correct Answer: Permanent correction is usually obtainable.

1892. (854) Q5-1117:

Which of the following statements is true about bone marrow transplantation in mucopolysaccharidoses:

1) Bone marrow transplantation is contraindicated.
3) Bone marrow transplantation reverses the orthopedic manifestations.
2) Bone marrow transplantation does not affect the orthopedic problems.
5) Bone marrow transplantation should be deferred until skeletal maturity.
4) Graft-versus-host disease is rare.

Bone marrow transplantation is effective in preventing the deposition of mucopolysaccharides in solid organs. Transplantation should be done early to prevent organ damage. Because the lysosomal enzyme does not cross the cell membrane of osteocartilaginous cells, it does not affect the orthopedic aspects. The risk of graft-versus-host disease is high but may be treated in most cases. Survival rate is 61% at 2 years for Hurler disease, which is otherwise fatal before maturity.

Correct Answer: Bone marrow transplantation does not affect the orthopedic problems.

1893. (855) Q5-1118:

A 3-year-old girl with spina bifida is able to flex and adduct her hips, but she cannot extend her knees. The hips are both dislocated. The patientâs parents ask how the hips must be treated to optimize function. The recommended treatment is:

1) Observation
3) Bilateral open reduction
2) Bilateral closed reduction
5) Bilateral open reduction with femoral osteotomies and muscle transfers
4) Bilateral open reduction and femoral osteotomies

Nonoperative treatment will allow the patient to retain maximum mobility of the hips.

Operative treatment carries substantial risk of avascular necrosis, stiffness, and redislocation. These risks are not worth taking in view of the patientâs limited muscle strength about the hips. In addition, the motor level alluded to (L2-L3) means that she will not have sensation of pain from the hips.

Correct Answer: Observation

1894. (856) Q5-1119:

A patient with spina bifida and L5 motor level undergoes tendon transfers about the ankle. After cast removal, he is lost to follow-up for 3 years. Upon re-examination, the patient has no motor power on either side below the knee. The most likely explanation is:

1) The tendon transfers have all pulled out.
3) His spinal cord has become tethered.
2) His ventriculoperitoneal shunt has malfunctioned.
5) He has sustained a silent compartment syndrome because of lack of sensation.
4) His muscles have fatigued.

This scenario is common. The most likely explanation of the patientâs loss of motor power on either side below the knee is a result of a tethered spinal cord.

- It is unlikely that all transferred tendons have pulled out and that he has lost function in all of the other L5 muscles that should be active.
- Shunt malfunction is a common occurrence in patients with spina bifida, but shunt malfunction does not present with a focal deficit at a distal level.
- Muscle fatigue is not a recognized phenomenon in spina bifida.

Correct Answer: His spinal cord has become tethered.

1895. (857) Q5-1120:

A 6-year-old boy with spina bifida and L3 motor level presents to the clinic with bilateral swollen legs (below the knees). His legs have been swollen for the past 3 days and his knees are warm. The patient has an oral temperature of 38.1Â°C. He denies any pain. There is no history of systemic infection or of any other trauma. The problem may be most likely diagnosed by ordering:

1) A venogram of both lower extremities
3) Cell count, gram stain, and culture of synovial fluid of both knees
2) A duplex ultrasound of both lower extremities and the pelvic veins
5) Plain and stress varus-valgus radiographs of both knees
4) Aspirate of both distal femoral metaphyses

Low-energy fractures are the most likely cause of the patientâs bilateral swollen legs. The fractures may occur with everyday activities, and they do not cause pain because of the patientâs high neurologic level. If plain radiographs do not give the diagnosis, stress radiographs should be obtained to detect undisplaced physeal fractures.

- Deep vein thrombosis is rare in this age group, especially bilaterally.
- Spontaneous joint infection and spontaneous osteomyelitis are not any more likely in patients with spina bifida than in the general population.

Correct Answer: Plain and stress varus-valgus radiographs of both knees

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1896. (858) Q5-1121:

A patient with spina bifida has significant symmetrical calcaneus positioning of both ankles. This is most likely due to:

1) Lack of ambulatory experience
3) Motor level at L3
2) Braces that are set in too much dorsiflexion
5) Motor level at S1
4) Motor level at L5

At motor level L5, dorsiflexors overpower plantarflexors to cause a calcaneus position.

- This condition occurs from muscle imbalance. Even with significant ambulation, it will persist.
- Brace properties do not cause fixed deformity.
- At L3, neither dorsiflexors nor plantarflexors of the ankle work.
- At S1, both dorsiflexors and plantarflexors are well innervated.

Correct Answer: Motor level at L5

1897. (859) Q5-1122:

Correction of the congenital gibbus in spina bifida must follow which of these surgical principles:

1) Long instrumentation
3) Avoidance of instrumentation
2) Short instrumentation
5) Anterior approach to deformity
4) Avoidance of bony resection

The leverage provided by long instrumentation prevents loss of correction and junctional deformity.

- Short instrumentation poses a risk of junctional kyphosis or loss of fixation.
- Because of the severe angular deformity, fusion in situ without correction will be followed by increasing deformity.
- Resection of one to three of the vertebrae on the lower limb of the kyphosis is essential to allow safe correction without excessive tension on vessels and viscera.
- The anterior approach to the gibbus is deep and impractical. This approach does not allow mechanically efficient instrumentation.

Correct Answer: Long instrumentation

1898. (860) Q5-1123:

A patient with L4 level myelomeningocele has developed a full-thickness pressure sore on the heel that has a central necrosis and is draining. While undergoing debridement in the local emergency department, the patient develops labored respiration and a nondetectable blood pressure. The most likely cause is:

1) Latex allergy
3) Septic shock
2) Aortic dissection
5) Shunt failure
4) Spontaneous tension pneumothorax

Latex sensitivity is common in patients with spina bifida because of frequent exposure through catherizations and procedures. Latex avoidance is becoming the standard in institutions that commonly treat patients with spina bifida, but community hospitals that rarely see such patients may not always be aware of this problem.

- Dissection is not likely unless the patient has a connective tissue disorder.
- Septic shock is not likely to develop from a freely draining peripheral ulcer.
- Tension pneumothorax is not any more likely in patients with spina bifida than in the general population.
- Although it is important to be aware of shunt failure, it is not likely in this procedure which is done without anesthetic.

Correct Answer: Latex allergy

1899. (884) Q5-1151:

The most common benign tumor of vertebral bodies is:

1) Osteoid osteoma
3) Osteochondrom
2) Osteoblastoma
5) Aneurysmal bone cyst
4) Giant cell tumor

Aneurysmal bone cyst is the most common benign bone tumor of the vertebral body. Aneurysmal bone cysts sometimes extend into the posterior elements.

- Osteoid osteoma, osteoblastoma, and osteochondroma are primarily found in the posterior elements of the vertebrae.
- Giant cell tumor is rare in the spine.

Correct Answer: Aneurysmal bone cyst

1900. (885) Q5-1152:

A magnetic resonance image of a 7-year-old girl shows a line of high-signal intensity within the cord on T2 sequences that parallels the ventral surface of the cord and appears as a syrinx. However, on the axial images and on the T1 sequences, this finding is not evident. The most likely diagnosis is:

1) Collapsing syrinx
3) Motion artifact
2) Gibbs artifact
5) Astrocytoma
4) Ependymoma

A Gibbs artifact is a linear focus in the cord on T2-weighted images that parallels the ventral aspect of the cord and mimics a syrinx. The Gibbs artifact is due to the linear interface between two tissues of differing signal intensity. It is not seen on axial images or T1-weighted images.

- Motion artifact is a blurring of the image due to patient motion, respiration, or cerebral spinal fluid pulsation.
- Ependymoma and astrocytoma are seen on both the axial and the sagittal images.

Correct Answer: Gibbs artifact

1901. (886) Q5-1154:

Which of the following statements correctly represents the definitions of Chiari I and Chiari II malformations:

1) A Chiari I malformation is displacement of the brainstem through the foramen magnum; a Chiari II malformation also includes the cerebellum.
3) A Chiari I malformation is a cyst in the pons; a Chiari II malformation is a cyst including the cerebellum.
2) A Chiari I malformation is displacement of the cerebellum through the foramen magnum; a Chiari II malformation also includes the brainstem.
5) A Chiari I malformation is a split in the spinal cord; a Chiari II malformation also includes a tight filum terminale.
4) A Chiari I malformation is an absence of the fourth ventricle; a Chiari II malformation also includes the presence of hydrocephalus.

A Chiari I malformation involves displacement of the cerebellum through the foramen magnum. A Chiari II malformation involves similar displacement of the brainstem, as well. In a Chiari II malformation, there is almost always a myelomeningocele in the lower cord. Sometimes a syrinx is also present.

Correct Answer: A Chiari I malformation is displacement of the cerebellum through the foramen magnum; a Chiari II malformation also includes the brainstem.

1902. (887) Q5-1155:

The conus medullaris is always termed abnormal if it terminates below this level:

1) L1
3) L2
2) L1-2 disk
5) L3
4) L2-3 disk

The vertebral bodies grow faster than the spinal cord. A more caudal placement of the conus medullaris is considered normal in an older patient. However, a conus medullaris below L3 at any age is abnormal and may represent a tethered and/or dysplastic cord.

Correct Answer: L3

1903. (888) Q5-1156:

Regardless of age, the tonsils of the cerebellum should not extend more than this distance below the foramen magnum:

1) 1 mm
3) 3 mm
2) 2 mm
5) Any protrusion is abnormal
4) 5 mm

Displacement of the cerebellar tonsils below the foramen magnum is termed a Chiari malfomation. A Chiari I malformation is an isolated malformation; a Chiari II malformation is associated with a syrinx. Symptoms may include headache, vomiting, and nystagmus. Although the normal protrusion allowed decreases with age, 5 mm is abnormal at any age.

Correct Answer: 5 mm

1904. (889) Q5-1157:

When applying a halo, the use of six pins instead of four has which of the following effects:

1) Increase in the infection rate
3) Increased rate of dural puncture
2) Increased rate of pin loosening
5) Increase in risk of injury of the supraorbital nerve
4) Increase in load to failure by 50%

With an increase from four to six pins, the load to failure is increased by more than 50%. Additional pins decrease many of the complications, such as loosening and pin tract infection. The risk of dural puncture is not measurably increased because it is a rare complication.

Correct Answer: Increase in load to failure by 50%

1905. (890) Q5-1158:

Which of the following findings is an indication for the Bernese (Ganz) osteotomy:

1) Acetabular dysplasia in a 10-year-old boy.
3) A 19-year-old man with osteonecrosis (Stulberg-Stage 4) secondary to Perthes disease.
2) A 20-year-old woman with a complete developmental dislocation of the hip.
5) A 35-year-old woman with an AP center-edge angle of 0Â° and a joint space of 2 mm
4) A 30-year-old woman with an anteroposterior (AP) center-edge angle of 10Â° and a joint space of 1 mm.

The Bernese (Ganz) osteotomy is contraindicated in patients with open triradiate cartilages because it crosses the cartilage. The procedure is also contraindicated in complete dislocations, incongruous hips, and advanced osteoarthritis with a joint space of 1 mm or less.

Correct Answer: A 35-year-old woman with an AP center-edge angle of 0Â° and a joint space of 2 mm

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1906. (891) Q5-1159:

The false profile radiographic view of the hip is taken with the patient in which of the following positions:

1) The effected hip is against the film and the pelvis is rotated 65Â° away from the plane of the film.
3) The patient is supine and the beam is angled 45Â° cephalad.
2) The uneffected hip is against the film and the pelvis is rotated 65Â° away from the plane of the film.
5) The patient is supine and the affected hip is maximally internally rotated.
4) The patient is supine and the beam is angled 45Â° caudally.

The false profile radiographic view assesses anterior coverage and is obtained with the affected hip against the film and the pelvis rotated 65Â° away from the plane of the film.

Correct Answer: The effected hip is against the film and the pelvis is rotated 65Â° away from the plane of the film.

1907. (892) Q5-1160:

A 15-year-old boy has a history of excessive bleeding when he is cut. His maternal uncle passed away during a tonsillectomy. The boy presents with severe hip pain (worse in extension than in flexion) and some weakness in his knee extension. The most likely cause of the patientâs symptoms is:

1) Septic arthritis of the hip
3) Lumbar epidural hematoma
2) Psoas abscess
5) Hip hemarthrosis
4) Iliopsoas hematoma

The patient has features suggesting mild hemophilia A or B including x-linked inheritance and occasional bleeding episodes. Iliopsoas hematoma is a complication of hemophilia. Bleed into the hip or the lumbar epidural space is less common and there are no signs to suggest infection.

Correct Answer: Iliopsoas hematoma

1908. (893) Q5-1161:

A patient with hemophilia A has a hematoma of the iliopsoas. He has a partial femoral nerve palsy. Treatment involves continuous factor replacement and:

1) Open drainage
3) Percutaneous insertion of a drainage tube
2) Decompression of the fascia over the femoral nerve
5) Observation
4) Embolization of feeder vessels by interventional radiologist

The standard treatment of a psoas abscess is continuous factor replacement. Surgery is usually unnecessary, but it may be considered in cases of acute palsy with severe pain unresponsive to medical therapy. A percutaneous drainage tube is not recommended because the hematoma may be difficult to locate or drain.

Correct Answer: Observation

1909. (894) Q5-1162:

Which of the following best predicts the risk of nonaccidental injury in young children who sustain a fracture of the femur:

1) The fracture pattern
3) The socioeconomic status of the family
2) The location of the fracture
5) Coexistence of other disabilities
4) Whether the child was previously able to walk

Although a spiral fracture is classically consistent with nonaccidental injury, this is not always true. A spiral fracture is often seen in accidental injuries. The location of the fracture in the femur, the socioeconomic status of the family, and the coexistence of other disabilities are all poor predictors. The ability of the child to walk has predictive ability. In one study, nonaccidental injury accounted for 42% of all femur fractures in children before walking age vs. only 2% of fractures after walking age.

Correct Answer: Whether the child was previously able to walk

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1910. (895) Q5-1163:

Which of the following is known about the genetics of multiple hereditary exostosis (MHE):

1) There is no genetic pattern for this condition.
3) MHE follows an autosomal recessive pattern.
2) MHE follows an x-linked inheritance pattern.
5) MHE involves a defect in fibroblast growth factor.
4) MHE encodes glycosyltransferases needed for biosynthesis of heparan sulfate.

Multiple hereditary exostosis (MHE) is inherited as an autosomal dominant condition. There are three genes known to be involved: EXT 1, 2, and 3. EXT 1 and 2 encode glycosyltransferases needed for biosynthesis of heparan sulfate. Fibroblast growth factor receptor is abnormal in achondroplasia.

Correct Answer: MHE encodes glycosyltransferases needed for biosynthesis of heparan sulfate.

1911. (896) Q5-1164:

A 10-year-old patient has a painful lytic lesion replacing 75% of the distal femoral metaphysis. The lesion has indistinct margins, but there is not any periosteal reaction. Biopsy reveals a benign histiocytic tumor with multiple eosinophils. Physical exam and skeletal survey reveal no other abnormalities. Which of the following would be the most appropriate treatment method:

1) Radiation therapy
3) Oral prednisone treatment for one month
2) Methotrexate, ifosfamide and adriamycin followed by resection
5) Curettage and bone graft
4) Resection and reconstruction

This patient has an eosinophilic granuloma, which is an isolated form of Langerhans cell histiocytosis. Patients with isolated involvement may be treated with observation, curettage, bone grafting, or steroid injection. For a lesion of this size, the risk of fracture is high and curettage with bone grafting is recommended. Chemotherapy and/or systemic steroids are reserved for patients with systemic disease.

Correct Answer: Curettage and bone graft

1912. (897) Q5-1165:

Which of the following methods has the highest sensitivity in detecting skeletal lesions in patients with Langerhans cell histiocytosis:

1) Physical examination
3) Ultrasound
2) Skeletal survey
5) Indium labeled white blood cell study
4) Bone scan

Skeletal survey is the most sensitive means of detecting lesions of eosinophilic granuloma (Langerhans cell histiocytosis). Bone scan detects most, but not all, of the lesions. Some lesions lack enough osteoblastic activity to appear on bone scan. Lesions are not detected on physical exam unless they are large enough to cause pain or tenderness. Indium labeled white cell studies are not used in this condition.

Correct Answer: Skeletal survey

1913. (898) Q5-1166:

A 15-year-old girl presents with pain and a 17Â°-scoliosis curve. The film suggests an enlargement and sclerosis of the transverse process of L2. The best study to further evaluate the nature and anatomic extent of the lesion is:

1) Coned radiographs
3) Bone scan with SPECT (single photon emission computed tomography)
2) Bone scintigraphy
5) Computed tomography
4) Magnetic resonance imaging

This lesion is most likely to be an osteoid osteoma or an osteoblastoma. The best study to further evaluate the nature and anatomic extent is with computed tomography.

Magnetic resonance imaging may overestimate the lesion because of sensitivity to edema in the marrow and surrounding soft tissue. Bone scintigraphy with or without SPECT does not provide enough anatomic detail. Coned radiographs do not provide the needed multidimensional detail for this condition, as well as many other spinal problems.

Correct Answer: Computed tomography

1914. (899) Q5-1167:

Fibrous dysplasia has been determined to be the result of a mutation in which gene:

1) GNAS1
3) FBN1
2) FGFR3
5) COL1A1
4) CFBA1

Fibrous dysplasia has been determined to be the result of a postzygotic mutation in the GNAS1 (stimulatory G protein of adenylyl cyclase) gene. All of the cells that are descended from the cell with the mutation manifest features of the disease.

- FGFR3 (fibroblast growth factor receptor-3 protein) is abnormal in achondroplasia.
- FBN1 (fibrillin 1) is abnormal in Marfan syndrome.
- CFBA1 is abnormal in cleidocranial dysplasia.
- COL1A1 (collagen, type 1, alpha 1) is abnormal in osteogenesis imperfecta.

Correct Answer: GNAS1

1915. (900) Q5-1168:

Which of the following conditions is not associated with congenital contractures:

1) Amyoplasia
3) Popliteal pterygium syndrome
2) Diastrophic dysplasia
5) Down syndrome
4) Larsen syndrome

Down syndrome is the only condition listed that does not involve congenital contractures.

- Amyoplasia (or classic arthrogryposis) involves multiple contractures with normal intelligence and loss of flexion creases.
- Diastrophic dysplasia is a disorder of cartilage that includes contractures of many joints, as well as epiphyseal irregularity.
- Popliteal pterygium syndrome includes contractures with webbing across the flexor surfaces of the joints.
- Larsen syndrome involves multiple joint dislocations, as well as contractures.

Correct Answer: Down syndrome

1916. (901) Q5-1169:

Diastematomyelia is best described as:

1) Protrusion of neural elements dorsally from the back.
3) Two hemivertebrae at adjacent levels.
2) A duplicated spinal column.
5) A cyst within the spinal cord.
4) An osseous or fibrocartilaginous septum in the spinal canal.

A diastematomyelia is an osseous or fibrocartilaginous septum within the spinal canal that invaginates or splits the neural tissue. A diastematomyelia may or may not be associated with neurologic deficit. Surgical excision is indicated for the presence of symptoms or at the time of spinal deformity correction.

Correct Answer: An osseous or fibrocartilaginous septum in the spinal canal.

1917. (902) Q5-1170:

Diastematomyelia is most common in which region of the spine:

1) Cervical
3) Lower thoracic
2) Upper thoracic
5) Sacral
4) Lumbar

Several series of patients with diastematomyelia have shown the following anatomic distribution: 64% occur in the lumbar spine, 27% occur in the lower thoracic spine, 9% in the upper thoracic spine, and almost none occur in the cervical or sacral regions.

Correct Answer: Lumbar

1918. (903) Q5-1171:

Which of the following is the most common finding in diastematomyelia:

1) Cutaneous lesions over the spine
3) Foot deformity
2) Anisomelia
5) Widened interpedicular distance
4) Neurologic deficit

Widened interpedicular distance is the most common finding (94% or greater) in patients with diastematomyelia.

- Neurologic deficit is present in 60% to 88% of patients with diastematomyelia.
- A cutaneous lesion, such as a dimple or hairy patch, is present in 55% to 79% of patients with diastematomyelia.
- Anisomelia is present in 53% to 58% of patients with diastematomyelia.
- Foot deformities are present in 32% to 52% of patients with diastematomyelia.

Correct Answer: Widened interpedicular distance

1919. (904) Q5-1172:

In which of the following clinical situations would it be most appropriate to recommend an anterior and posterior hemiepiphyseodesis of the convex side of a congenital scoliosis:

1) A 12-year-old girl with a hemivertebra of L3.
3) A 5-year-old boy with a congenital bar of T3-4.
2) A 10-year-old boy with a hemivertebra of L3.
5) A 5-year-old boy with a hemivertebra of L5.
4) A 5-year-old boy with a hemivertebra of T5.

Hemiepiphyseodesis is most likely to produce progressive curve correction in patients under age 6. Hemiepiphyseodesis is not likely to result in improvement when there is no concave growth potential, as in the case of a congenital bar. In hemivertebra of the lumbosacral region, improvement is most likely when a hemivertebra resection is performed.

Correct Answer: A 5-year-old boy with a hemivertebra of T5.

1920. (905) Q5-1173:

Which of the following is the seating arrangement recommended for a 5-year-old in a family automobile:

1) Lap belt in the middle of the back seat
3) Lap and shoulder belt and booster seat in back
2) Lap and shoulder belt in the back seat
5) Lap and shoulder belt and booster seat in front
4) Rear-facing child seat in back

Children ages 4 to 8 (40 lbs to 60 lbs) are at risk for airbag injuries and should not be in the front seat. In addition, they require booster seats to allow proper fitting of the shoulder harness on the upper torso. Rear-facing seats are only appropriate for infants. Children should not be in the front seat until after age 12 and over 100 lbs.

Correct Answer: Lap and shoulder belt and booster seat in back

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1921. (906) Q5-1174:

Immediate internal fixation of diaphyseal fractures in polytraumatized children has been shown to provide which of the following benefits:

1) Increased survival rate
3) Decreased incidence of deep venous thrombosis
2) Decreased incidence of fat emboli
5) Greater ease of management
4) Improved recovery of central nervous system function after head injury

Acute internal fixation in children has not been shown to provide the same life-saving and morbidity-reducing benefits as in adults. However, it will ease the management of the polytraumatized patient.

Correct Answer: Greater ease of management

1922. (907) Q5-1175:

Which of the following statements is true about pin fixation of supracondylar humerus fractures:

1) Fixation with two lateral pins is biomechanically stronger than crossed pins.
3) Pin fixation is associated with a higher risk of compartment syndrome than cast treatment alone.
2) Fixation with two lateral pins has a higher risk of iatrogenic nerve injury than medial and lateral pins.
5) Use of two medial pins is the most biomechanically stable construct.
4) Fixation with medial and lateral pins carries a higher risk of iatrogenic ulnar nerve injury than two lateral pins.

Pin fixation of supracondylar humerus fractures in children decreases the risk of compartment syndrome as well as malreduction. Use of medial and lateral pins has been shown to be the most stable construct in biomechanical studies. The use of medial and lateral pins carries a risk of iatrogenic injury to the ulnar nerve. No nerve injuries have been demonstrated after the use of two lateral pins.

Correct Answer: Fixation with medial and lateral pins carries a higher risk of iatrogenic ulnar nerve injury than two lateral pins.

1923. (908) Q5-1176:

A 6-year-old boy who is treated for a type III supracondylar fracture has no neurovascular deficit on initial examination. His fracture is treated by anatomic closed reduction and percutaneous fixation with medial and lateral pins. A partial deficit in ulnar motor and sensory function is noted after surgery. The next step in treatment should be:

1) Remove the lateral pin.
3) Explore the ulnar nerve.
2) Remove both pins and place the patient in traction.
5) Make sure the elbow is flexed to no more than 90Â° and observe.
4) Transpose the ulnar nerve anteriorly.

The use of medial pins in treatment of supracondylar fractures of the humerus has been associated with a risk of ulnar nerve injury. However, in the largest reported series, 16 of 17 palsies resolved spontaneously and completely with observation after a mean of 18 weeks. There is no evidence that pin removal, exploration, or transposition is necessary at this stage. Hyperflexion in a splint may cause the nerve to be apposed to the pin and can be decreased.

Correct Answer: Make sure the elbow is flexed to no more than 90Â° and observe.

1924. (909) Q5-1177:

Which of the following factors is associated with a decrease in the accuracy of measurement of congenital scoliosis:

1) Increase in the size of the curve
3) Increased level of training in deformity surgery
2) Decrease in the size of the curve
5) Use of the Ferguson technique instead of the Cobb technique
4) Film coned and centered on the deformity

Measurement of congenital scoliosis has an intraobserver variation of 8Â°. Measurement accuracy decreases with decreased level of training, increased curve size, and decreased clarity of the endpoints. A coned and centered film would give better detail.

Correct Answer: Increase in the size of the curve

1925. (910) Q5-1178:

Which of the following structures enables the growth plate to grow in diameter as the skeleton gets larger:

1) The chondroepiphysis
3) The groove of Ranvier
2) The apophysis
5) The secondary spongiosa
4) The ring of LaCroix

The ossification groove of Ranvier contains chondrocytes that provide latitudinal growth of the growth plate. The groove of Ranvier may be thought of as âthe growth ring of the growth plate.â

- The chondroepiphysis is the cartilage precursor of the epiphysis.
- The apophysis is a nonarticular growth region.
- The ring of LaCroix is a peripheral structure that reinforces the growth plate.
- The secondary spongiosa is mature lamellar bone after it has been remodeled.

Correct Answer: The groove of Ranvier

1926. (911) Q5-1180:

Which area of the growth plate has the lowest oxygen tension:

1) The reserve zone
3) The hypertrophic zone
2) The proliferative zone
5) The perichondral ring
4) The zone of calcification

The lowest pressure of oxygen is in the hypertrophic zone because it is poorly vascularized. This is one of the features that triggers cell death and calcificaton.

Correct Answer: The hypertrophic zone

1927. (912) Q5-1181:

How many major centers of ossification comprise the normal lumbar vertebral body:

1) One
3) Three
2) Two
5) Five
4) Four

The normal lumbar and thoracic vertebrae are comprised of two posterior and one main anterior ossification center. These join at the neurocentral synchondrosis and the midline vertebal ossification center.

Correct Answer: Three

1928. (913) Q5-1182:

The somite refers to which of the following features of embryologic development:

1) A group of cells that produce the limb bud
3) A group of cells that differentiate to form the cranium
2) A structure that gives rise to the spinal cord
5) A set of homeobox genes
4) A group of cells that are repeated to form the axial skeleton

The somite is a group of tissues that are bilaterally symmetric and repeated to comprise the axial skeleton. Each somite contains a dermatome, myotome, and sclerotome.

Correct Answer: A group of cells that are repeated to form the axial skeleton

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1929. (914) Q5-1183:

Homeobox genes are best characterized by which of the following descriptions:

1) Homeobox genes regulate fracture healing.
3) Homeobox genes are a series of genes that regulate limb genesis.
2) Homeobox genes are involved in immune system regulation.
5) Homeobox genes regulate vascular invasion of the physis.
4) Homeobox genes regulate spinal development.

Homeobox genes code for transcription factors involved in regulation of limb genesis in the embryonic period. Homeobox genes have a highly conserved 60-nucleotide sequence.

Correct Answer: Homeobox genes are a series of genes that regulate limb genesis.

1930. (915) Q5-1184:

Which of the following regions of the physis has the highest degree of proteoglycan aggregation in the matrix:

1) Reserve zone
3) Hypertrophic zone
2) Proliferative zone
5) Metaphysis
4) Zone of degeneration

The proteoglycan aggregation is greatest in the reserve zone and in the epiphysis. Proteoglycan concentration progressively decreases in the direction of the metaphysis. This phenomenon also enables calcification to occur.

Correct Answer: Reserve zone

1931. (4040) Q5-1186:

Which of the following categories of slipped capital femoral epiphysis (SCFE) is associated with the highest rate of bilaterality:

1) Idiopathic SCFE
3) Radiation therapy
2) Renal failure
5) Growth hormone deficiency
4) Hypothyroidism

Renal failure is associated with the highest risk (90%) of bilaterality. By contrast, idiopathic SCFE has a 20% risk of bilaterality initially and a further 10% to 20% risk until maturity.

Correct Answer: Renal failure

1932. (916) Q5-1187:

An African-American mother brings her 18-month-old baby in for examination because he has bowing of the legs. The childâs past medical history is normal including height and weight. The child is still breast-fed. Radiographs reveal mild widening and irregularity of the physes. Which of the following conditions is likely to be found on laboratory examination:

1) Elevated phosphorus
3) Normal 1,25 dihydroxyvitamin D
2) Decreased alkaline phosphatase
5) Elevated parathyroid hormone
4) Elevated creatinine

This patient has nutritional rickets because of a combination of decreased vitamin D intake and increased need for sunlight due to dark skin. The laboratory findings should include a lowânormal calcium phosphate, elevated alkaline phosphatase and parathryoid hormone, and low vitamin D levels and precursors. Vitamin D supplementation without bracing is adequate treatment.

Correct Answer: Elevated parathyroid hormone

1933. (917) Q5-1188:

The dose of acetaminophen for a child should be no more than:

1) 1.5 mg/kg
3) 10-15 mg/kg
2) 5 mg/kg
5) 50 mg/kg
4) 20-30 mg/kg

The dose of acetaminophen should be 10-15 mg/kg. The maximum daily dose should be no more than 75 mg/kg. Larger doses of acetaminophen pose a risk of hepatotoxicity over a long period of time.

Correct Answer: 10-15 mg/kg

1934. (918) Q5-1189:

Opioids must be used with caution in infants younger than 3 months of age because of which of the following properties:

1) Increased clearance
3) Increased hepatic activity
2) Increased protein binding
5) Decreased body surface area to mass
4) Decreased clearance and protein binding

Opioids must be used with caution in infants younger than 3 months of age because of decreased clearance and decreased protein binding. This results in greater bioavailability.

Correct Answer: Decreased clearance and protein binding

1935. (919) Q5-1190:

The potency ratio of hydromorphone to morphine sulfate is:

1) 1-2:1
3) 7-10:1
2) 5:1
5) 50:1
4) 20-25:1

The potency ratio of commonly-used drugs is one of the factors that determines the appropriate dose of a drug. The potency ratio of hydromorphone to morphine sulfate is 7-10:1.

Correct Answer: 7-10:1

1936. (920) Q5-1191:

The youngest age at which a number scale to quantitate pain (i.e., rating it as 1-10) can be appropriately used is:

1) 2 years
3) 5 years
2) 3 years
5) 9 years
4) 7 years

Pain measurement is becoming increasingly important for both children and adults. A number scale to quantitate pain can be appropriately used for most children over the age of 7 years. For younger children, the âfaces scaleâ or a finger span scale (stretching the fingers as far apart as possible) is more accurate.

Correct Answer: 7 years

1937. (921) Q5-1192:

Which of the following findings on a neuromuscular examination is not characteristic of spasticity:

1) Hyperreflexia
3) Velocity-dependent resistance
2) Clonus
5) Muscle contracture
4) Writhing movements

Spasticity is a hallmark of upper motor lesions. Spasticity is characterized by hyperreflexia, clonus, and velocity-dependent resistance. After early childhood, muscle contracture also develops. Writhing movements are characteristic of athetosis, not spasticity.

Correct Answer: Writhing movements

1938. (922) Q5-1193:

Which of the following describes the mechanism of action of Botulinum toxin type A:

1) Botulinum toxin type A blocks the release of acetylcholine.
3) Botulinum toxin type A interrupts transmission of impulses along axons.
2) Botulinum toxin type A prevents binding of acetylcholine to receptors.
5) Botulinum toxin type A depolarizes sarcolemma of muscles.
4) Botulinum toxin type A softens fibrous tissue causing contracture.

Botulinum toxin type A acts by blocking the release of acetylcholine at the nerve terminal. Over time, new terminals sprout and the effect is lost. By contrast, alcohol and phenol denature proteins and disrupt nerve conduction.

Correct Answer: Botulinum toxin type A blocks the release of acetylcholine.

1939. (923) Q5-1194:

Which of the following describes the mechanism of action of baclofen:

1) Baclofen mimics the effect of gamma-aminobutyric acid (GABA).
3) Baclofen binds to actylcholine receptors.
2) Baclofen blocks the effect of GABA.
5) Baclofen inhibits serotonin reuptake.
4) Baclofen potentiates the effect of actylcholine.

Baclofen mimics the effect of gamma-aminobutyric acid, an inhibitory neurotransmitter in both the peripheral and central nervous system. Baclofen reduces peripheral spasticity. A major side effect of baclofen is sedation. The ratio of sedation to spasticity reduction may be enhanced by intrathecal administration.

Correct Answer: Baclofen mimics the effect of gamma-aminobutyric acid (GABA).

1940. (924) Q5-1195:

The migration index of Reimers is best described as:

1) The vertical migration of the center of the femoral head with respect to the lateral margin of the acetabulum.
3) The ratio of the uncovered portion of the femoral head to its total width.
2) The distance between the medial wall of the acetabulum and the femoral head.
5) The angle between two lines through the center of the femoral head â one vertical and one through the lateral edge of the acetabulum.
4) The difference in subluxation between neutral and abduction films.

The migration index of Reimers is used to quantitate hip subluxation in cerebral palsy. It is defined as the ratio of the uncovered portion of the femoral head (lateral to a vertical line through the outer edge of the acetabulum) to the total width of the head.

Correct Answer: The ratio of the uncovered portion of the femoral head to its total width.

1941. (925) Q5-1196:

An appropriate indication for preoperative magnetic resonance imaging in adolescent idiopathic scoliosis is:

1) Any curve requiring surgery
3) An abnormal neurologic examination
2) Any curve more than 90Â°
5) Any progression of 12Â° in 6 months
4) Any progressive deformity in a male

The only absolute indication for preoperative magnetic resonance imaging in idiopathic adolescent scoliosis is an abnormal neurologic exam or abnormal curve pattern.

Correct Answer: An abnormal neurologic examination

1942. (926) Q5-1197:

The mean Cobb measurement for idiopathic scoliosis curves with a 7Â° angle of trunk rotation (ATR) is:

1) 10Â°
3) 20Â°
2) 15Â°
5) 30Â°
4) 25Â°

Although the angle of trunk rotation (ATR) does not convert directly to a Cobb angle, there are population-based figures for mean curve at each ATR. The mean Cobb angle for curves having a 7Â° ATR is 20Â°.

Correct Answer: 20Â°

1943. (927) Q5-1198:

Using a 5Â° angle trunk rotation (ATR) as a positive screening threshold for detection of curves with a Cobb angle over 20Â° is characterized by:

1) A high degree of sensitivity and specificity
3) A high degree of specificity but low sensitivity
2) A high degree of sensitivity but low specificity
5) No predictable relationship to Cobb angle
4) A low degree of sensitivity and specificity

Use of a 5Â° ATR threshold for detection of curves with a Cobb angle over 20Â° has a sensitivity of 98%, but a specificity of only 64%.

Correct Answer: A high degree of sensitivity but low specificity

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1944. (928) Q5-1199:

The normal values (Â±2 standard deviations) for kyphosis in the general population of children and adolescents are:

1) 20Â° to 50Â°
3) 25Â° to 45Â°
2) 20Â° to 40Â°
5) 30Â° to 60Â°
4) 25Â° to 60Â°

The normal values for kyphosis in the general population (2 standard deviations above and below the mean) are 20Â° to 50Â°.

Correct Answer: 20Â° to 50Â°

1945. (929) Q5-1200:

Which of the following is the most common cause of death in children with pelvic fractures:

1) Intrapelvic exsanguination
3) Pulmonary embolism
2) Head injury
5) Spinal cord injury
4) Multisystem organ failure

Head injury is the cause of virtually all mortality in children with pelvic fractures. The rarity of life-threatening intrapelvic hemorrhage is in marked contrast to adults. Pulmonary embolism and multisystem organ failure are rare in children.

Correct Answer: Head injury

1946. (930) Q5-1201:

An 8-year-old pedestrian sustains a pelvic fracture when struck by a car. The injury consists of a posterior iliac fracture in which the iliac wing is rotated internally, although it is not vertically displaced. An anterior fracture of both ipsilateral pubic rami is present with 2 cm of overlap. Recommended treatment includes:

1) Open reduction and plate fixation of the rami
3) Percutaneous sacral screw fixation
2) Open reduction and plate fixation of the iliac wing
5) Bedrest
4) External fixation

A childâs pelvis can absorb a significant amount of energy without serious displacement. There is rapid healing and good remodeling potential. Bedrest is the appropriate treatment for this patient because of the low risk of complications.

Correct Answer: Bedrest

1947. (931) Q5-1202:

Which of the following factors should prompt a workup for an underlying disorder in a patient with slipped capital femoral epiphysis:

1) A bilateral slip
3) Weight under the 50th percentile for age
2) Weight over the 50th percentile for age
5) A slip of grade II or higher
4) A positive family history

A positive age-weight test is defined as a patient who is under the 50th percentile of weight for age or older than 16 years of age at presentation with slipped capital femoral epiphysis. These patients should have a workup for underlying renal or endocrine disease. A positive family history is found in 5% to 10% of patients with slipped capital femoral epiphysis.

Correct Answer: Weight under the 50th percentile for age

1948. (932) Q5-1203:

Which of the following categories of slipped capital femoral epiphysis (SCFE) is associated with the highest risk of a grade III slip:

1) Idiopathic SCFE
3) Radiation therapy
2) Renal failure
5) Growth hormone deficiency
4) Hypothyroidism

A grade III slip refers to more than 50% displacement of the epiphysis. Renal failure is associated with the highest risk (43%) of progressing to a grade III slip. Fortunately, these slips are usually stable.

Correct Answer: Renal failure

1949. (1089) Q5-1449:

Which of the following is the central element of Klippel-Feil syndrome:

1) A low posterior hairline
3) Cervical stenosis
2) Hearing impairment
5) Cervical scoliosis
4) Congenital cervical fusion

The essential feature of the definition of Klippel-Feil syndrome is congenital cervical fusion. Features other than congenital cervical fusion are sometimes seen but are not essential features of the syndrome. Features other than those listed above include scoliosis in different regions of the spine, congenital heart defects, a short neck, Sprengel deformity, and renal anomalies.

Correct Answer: Congenital cervical fusion

1950. (1090) Q5-1450:

The most common cause of neurologic deficit in patients with Down syndrome is:

1) Basilar invagination
3) Atlantoaxial instability
2) Atlanto-occipital instability
5) Cervical kyphosis
4) Subaxial instability

Basilar invagination is extremely rare in this syndrome, and problematic cervical kyphosis is equally uncommon. Atlanto-occipital translation and subaxial instability occur but rarely cause symptoms. Atlantoaxial instability is the most common of the cervical abnormalities listed to cause neurologic compromise in Down syndrome. Nevertheless, surgery is only indicated if the atlantoaxial interval exceeds 6 mm, or causes neurologic deficits.Correct Answer: Atlantoaxial instability

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1951. (1091) Q5-1451:

The timing of maximal progression of idiopathic scoliosis is most closely correlated with:

1) Chronological age
3) Peak height velocity
2) Skeletal age
5) Tanner stage
4) Risser sign

The cause of scoliosis or its progression is still not known. However, the timing of the progression is most closely correlated with the peak velocity of growth. The other factors are more weakly correlated: a chronological or skeletal age of 10 to 12 years, Risser sign of 0, or Tanner sign of 0 to 1.Correct Answer: Peak height velocity

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1952. (1092) Q5-1452:

Which of the following events typically occurs first in adolescent girls:

1) Risser sign turning to 1
3) Menarche
2) Peak height velocity
5) Tanner sign of 3
4) Skeletal maturity

Typically, the peak height velocity is the first of these events to occur in adolescent girls. Skeletal maturity is the last event to occur.Correct Answer: Peak height velocity

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1953. (1093) Q5-1453:

A 15-year-old with idiopathic scoliosis develops a temperature of 39.5Â° C 8 days after posterior spinal fusion with instrumentation. Blood and urine cultures show no growth, and chest X-ray is normal. Your next step should be which of the following:

1) Begin intravenous cephalosporin treatment
3) Aspirate the wound for culture
2) Begin intravenous vancomycin treatment
5) Debride the wound and remove the bone graft
4) Debride the wound and remove the instrumentation

There is a significant likelihood of a deep wound infection, although other possibilities exist, including superficial wound infection, atelectasis, and drug-related fever. Therefore, confirmation of the diagnosis is the next step. The wound should be aspirated for culture next. If infection is confirmed, the wound should be opened and debrided.Correct Answer: Aspirate the wound for culture

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1954. (1094) Q5-1454:

Nine days after surgery, a 16-year-old boy with idiopathic scoliosis has a temperature of 39.5Â° C. Wound aspiration reveals gram-positive cocci in clusters. Your next step in management is:

1) Begin intravenous cephalosporin and monitor the response
3) Begin hyperbaric oxygen and intravenous antibiotics
2) Begin intravenous vancomycin and monitor the response
5) Open and debride the wound, and remove the instrumentation
4) Open and debride the wound, leaving the instrumentation in place

Open debridement is the treatment of choice if an early deep wound infection is confirmed after spinal fusion. The instrumentation is left in place to stabilize the wound and promote fusion. The wound is closed as long as it can be cleaned up adequately during surgery, and muscle has a healthy appearance. If this cannot be achieved or if several debridements fail, the wound may be left open.Correct Answer: Open and debride the wound, leaving the instrumentation in place

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1955. (1095) Q5-1455:

A thoracic curve of more than 50Â° due to an idiopathic adolescent scoliosis curve has an increased risk of causing all except which of the following consequences in adulthood, when compared to the general population:

1) Restrictive lung disease
3) Back pain
2) Obstructive lung disease
5) Increase in curvature
4) Less positive body image

Idiopathic adolescent scoliosis is likely to progress in adulthood if it exceeds 50Â°. The rate of progression in adults is slower than during adolescence; about 1Â° per year. Nevertheless, it is likely to have some effect on pulmonary function later during adulthood. The effect is one of restrictive rather than obstructive lung disease. There is an increase in the risk of back pain, although it is rarely disabling. Patients with idiopathic scoliosis as a group have a more negative body image, although it is not a serious life impairment. In all of these parameters, there are individual exceptions.Correct Answer: Obstructive lung disease

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1956. (1096) Q5-1456:

A 13-year-old girl with idiopathic adolescent scoliosis has a 32Â° right thoracolumbar curve. Her Risser sign is 1. Her curve measured 29Â° 4 months ago. You recommend:

1) Observing until the curve reaches 34Â°
3) Physical therapy to control the curve
2) Ordering a magnetic resonance image of the spine
5) A thoracolumbosacral orthosis
4) Electrical stimulation to the paraspinal muscles

Idiopathic scoliosis in skeletally immature patients should be braced if it is greater than 30Â° and significant growth remains (estimated by a Risser sign of 0, 1, or 2). Studies have shown that patients with idiopathic scoliosis without atypical findings do not need magnetic resonance imaging. Physical therapy and electrical stimulation have been shown not to have any effect on the progression of idiopathic scoliosis.Correct Answer: A thoracolumbosacral orthosis

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1957. (1097) Q5-1457:

Which of the following factors are not related to the success of brace treatment for idiopathic scoliosis?

1) Curve size at start of treatment
3) Number of hours worn
2) Curve correction in brace
5) Positive family history of scoliosis
4) Gender

A lower chance of curve control with brace treatment has been shown with curves greater than 40Â°, correction of less than 50% in brace, brace worn fewer than 16 hours per day, or male gender. Positive family history has not been shown to be related to curve progression or chance of control.Correct Answer: Positive family history of scoliosis

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1958. (1098) Q5-1458:

A 12-year-old patient has a rigid, 135Â° scoliosis. Gradually increasing halo-gravity traction is planned in correcting the curve. The maximum weight that should be used is:

1) 15% of body weight
3) 25% of body weight
2) 20% of body weight
5) 35% to 45% of body weight
4) 30% of body weight

Halo-gravity traction is a safe and effective means of gradually correcting large curves. It allows balanced force application and continuous neurological monitoring. Cranial and peripheral nerves should be monitored. The weight can be increased gradually up to 35% to 45% of body weight, as documented in published series.Correct Answer: 35% to 45% of body weight

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1959. (1099) Q5-1459:

In evaluating infants for Blount disease, which diagnostic parameter allows correct classification of the greatest number of children:

1) Langenskjold rating
3) Tibial metaphyseal-diaphyseal (M-D) angle
2) Tibiofemoral angle
5) Femoral intercondylar distance divided by height
4) Femoral M-D angle divided by tibial M-D angle

The tibial metaphyseal-diaphyseal (M-D) angle, no matter what threshold is set, has a significant number of false-positives or false-negatives. Using the ratio of femoral to tibial M-D angle improves diagnostic accuracy significantly. The Langenskjold rating, tibiofemoral angle, and intercondylar distances, although conceptually important, have low diagnostic accuracy for an individual patient.Correct Answer: Femoral M-D angle divided by tibial M-D angle

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1960. (1100) Q5-1460:

Which of the following statements best characterizes a Dega osteotomy as a distinct osteotomy from a Salter osteotomy:

1) The Dega osteotomy is stabilized by threaded pins.
3) The Salter osteotomy hinges upon the triradiate cartilage.
2) The Dega osteotomy lengthens the ipsilateral limb.
5) The Dega osteotomy should only be done after triradiate cartilage closure.
4) The Dega osteotomy hinges upon the medial pelvic cortex.

The Dega osteotomy, originally described in Poland in 1964, is an incomplete transiliac osteotomy. The medial pelvic cortex is largely preserved, and the osteotomy hinges upon this point. Both osteotomies are best performed in young children, before triradiate cartilage closure. The Salter osteotomy is stabilized by pins, so the Dega needs no internal fixation. The Salter osteotomy lengthens the limb because it is a complete osteotomy.Correct Answer: The Dega osteotomy hinges upon the medial pelvic cortex.

1961. (1101) Q5-1461:

After the bone age of 15 years, boys will achieve the most growth from which of the following regions:

1) Distal femoral epiphysis
3) Distal tibial epiphysis
2) Proximal tibial epiphysis
5) Spine
4) Ilium and pelvis

After the age of 15 in boys (13 in girls), most of the growth (4.5 cm on average) occurs in the spine.Correct Answer: Spine

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1962. (1102) Q5-1462:

The most accurate way to monitor the motor tracts during spinal surgery is to stimulate which of the following regions:

1) Tibial nerve
3) Motor cortex
2) Peroneal nerve
5) Proximal spinal cord
4) Gastrocnemius

The most accurate way to monitor the motor tracts of the spinal cord is to stimulate the motor cortex. Stimulation at the level of the spinal cord conducts mainly antidromically through sensory pathways. Stimulation of the tibial and peroneal nerve is performed for monitoring sensory pathways only; these are an important indicator of spinal cord integrity but do not monitor the motor pathways per se. Stimulation of the gastrocnemius does not have any value for monitoring.Correct Answer: Motor cortex

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1963. (1103) Q5-1463:

Which of the following most definitively makes the diagnosis of Sever disease:

1) Sclerosis of the calcaneal apophysis on x-ray
3) Tenderness over the Achilles tendon
2) Irregularity of the calcaneal apophysis
5) Limitation of subtalar motion
4) Tenderness over the calcaneal apophysis

There are no radiographic findings diagnostic of Sever disease. Sclerosis and irregularity are normal findings, although they are often mistakenly called evidence of disease. The diagnosis of Sever disease is made by tenderness over the calcaneal apophysis.Correct Answer: Tenderness over the calcaneal apophysis

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1964. (1104) Q5-1464:

A 12-year-old boy comes to your office 2 weeks after a distal radius physeal fracture, which has been splinted in the emergency department. The epiphysis is displaced dorsally by 50%, and the articular surface has a dorsal tilt of 17Â°. You recommend:

1) Closed manipulation with sedation
3) Open reduction, internal fixation
2) Closed manipulation under anesthesia with relaxation
5) Percutaneous pin fixation in current position
4) Cast application and observation

Distal radial physeal fractures are common injuries. Reduction should be done gently and not repeated multiple times. Fractures presenting late like this one are difficult to manipulate atraumatically, but have good remodeling potential. Therefore, a cast should be applied to limit any further displacement, but no manipulation or operation is recommended.Correct Answer: Cast application and observation

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1965. (1105) Q5-1465:

Which of the following lowers the chance of a good result from stretching of muscular torticollis in infants:

1) Palpable mass in the sternocleidomastoid muscle
3) Rotation to neutral
2) Age at presentation less than 1 month
5) High birth weight
4) Absence of plagiocephaly

Stretching produces good results in more than 90% of infants. Presence of a palpable mass in the sternomastoid predicts a lower success rate than absence of such a mass. The other factors are either positive or neutral.Correct Answer: Palpable mass in the sternocleidomastoid muscle

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1966. (1106) Q5-1466:

A 14-year-old boy suffers a hip dislocation in a motor vehicle accident. It is reduced by closed means. The risk of avascular necrosis is:

1) Less than 5%
3) 20%
2) 10%
5) 50%
4) 40%

Avascular necrosis is a risk of traumatic hip dislocation. The risk is closest to 10%.Correct Answer: 10%

1967. (1107) Q5-1467:

Which of the following statements is true of the King classification of idiopathic scoliosis:

1) It takes into account sagittal alignment of curves.
3) It classifies all possible curve patterns.
2) It defines structural and nonstructural curves.
5) It has more curve types than the Lenke system.
4) It has a lower interobserver reliability than the Lenke system.

The Lenke system is more comprehensive than the King system, for the latter considers the entire range or thoracolumbar and lumbar curve possibilities, as well as the sagittal plane. The Lenke system also appears to have a higher interobserver reliability.Correct Answer: It has a lower interobserver reliability than the Lenke system.

1968. (1108) Q5-1468:

The most common form of chondrodysplasia punctata is much more common in girls than in boys. Which of the following explains this:

1) Autosomal dominant inheritance
3) X-linked recessive inheritance
2) X-linked dominant inheritance
5) The imprinting phenomenon
4) Autosomal recessive inheritance

X-linked dominant inheritance would explain the preponderance of girls with this condition, because they have twice as great a chance of having an affected x-chromosome. One affected x-chromosome is sufficient to convey the disease in a dominant condition. The imprinting phenomenon refers to a condition that varies depending upon whether the mother or the father passed it on (as in Angelman versus Prader-Willi syndromes).Correct Answer: X-linked dominant inheritance

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1969. (1109) Q5-1469:

A 9-year-old boy injures his elbow in a fall from a 12-foot height. Radiographs reveal a posterior dislocation of the elbow with a fracture of the medial epicondyle which is displaced. The ossification center is 5 mm in diameter. You recommend:

1) Open reduction internal fixation with a smooth pin
3) Open reduction and fixation with a suture
2) Open reduction internal fixation with a small screw
5) Closed reduction of the dislocation and application of a splint
4) Open reduction with excision of the fragment and suture of the medial collateral ligament

A recent long-term study has shown that open reduction of displaced medial epicondyle fractures does not yield superior results to closed treatment. This applies even when the elbow is initially dislocated. Excision of the epicondyle with suture of the ligament yields the highest incidence of late problems, such as flexion contractures and degenerative changes.Correct Answer: Closed reduction of the dislocation and application of a splint

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1970. (1110) Q5-1470:

The most accurate and practical means of determining pregnancy status in adolescent females undergoing surgery is:

1) Self report
3) Serum HCG
2) Morning urine human chorionic gonadotropin (HCG)
5) Serum estrogen levels
4) Serum alpha fetoprotein

Anesthesia and surgery can be detrimental to a fetus, especially during the first trimester. Patient self-report is not accurate in many cases. Immunospot testing of the first morning urine for human chorionic gonadotropin is 99.4% sensitive and specific, rapid, and inexpensive. Serum HCG testing is less rapid and more expensive; therefore, not appropriate for surgical screening. The other tests are not used to ascertain pregnancy status.Correct Answer: Morning urine human chorionic gonadotropin (HCG)

1971. (1111) Q5-1471:

Which of the following is considered a critical element in surgically correcting posttraumatic elbow flexion contractures in adolescents:

1) Lengthening of the biceps muscle
3) Perioperative indomethacin
2) Lengthening of the triceps muscle
5) Postoperative continuous passive motion and physical therapy
4) Pre- or postoperative radiation

Bae and Waters have shown that adolescents with significant posttraumatic elbow flexion contractures can gain an average of 54Â ° of motion with surgical release. They believe postoperative physical therapy and continuous passive motion are considered critical to success of surgical release. Lengthening of the biceps or triceps is not recommended. Measures to prevent postoperative heterotopic ossification did not influence the outcome.Correct Answer: Postoperative continuous passive motion and physical therapy

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1972. (1112) Q5-1472:

Which of the following statements is true concerning atlanto-occipital dislocations in children:

1) The dens-basion distance is greater than 10 mm.
3) The injury is not survivable.
2) The power ratio is greater than 1.0.
5) No single plain radiographic finding is always diagnostic.
4) Spinal cord injury always accompanies this dislocation.

Pediatric atlanto-occipital dislocation is increasing in frequency due to improved emergency care. Although the injuries are sometimes fatal and are often accompanied by severe spinal cord injury, this is not always the case. Although the dens-basion distance should be less than 10 mm and the power ratio should be less than 1 in normals, these are not always abnormal in children with such injuries. Clinical and radiographic correlation, with computer tomography or magnetic resonance imaging if needed, are called for to maximize diagnosis.Correct Answer: No single plain radiographic finding is always diagnostic.

1973. (1113) Q5-1473:

Equinovarus positioning of the foot is normal during which stage of embryonic life:

1) No stage
3) Thirteenth to fifteenth week
2) Eighth to tenth week
5) Twentieth to twenty-third week
4) Seventeenth to nineteenth week

As the foot matures, it passes through a normal stage when it resembles a clubfoot in the eighth to tenth week. After this, the foot normally corrects itself.Correct Answer: Eighth to tenth week

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1974. (1114) Q5-1474:

Which of the following is a similarity between congenital pseudarthrosis of the clavicle and congenital pseudarthrosis of the tibia:

1) Both are common in neurofibromatosis
3) Both have a low rate of union after treatment with autograft unless it is vascularized
2) Both are common in cleidocranial dysplasia
5) Both may present with tapered, atrophic bone ends at the pseudarthrosis
4) Both are more common on the left side

Congenital pseudarthrosis of the clavicle and tibia may present in infants with a gap between two tapered, atrophic bone ends. However, they are dissimilar in other respects. Pseudarthrosis of the clavicle is seen almost exclusively on the right side, while that of the tibia is seen on either side. Pseudarthrosis of the clavicle may be seen in cleidocranial dysostosis, although tibial pseudarthrosis is not. Pseudarthrosis of the clavicle has a high rate of union with simple bone graft, while that of the tibia does not. One-half of patients with pseudarthrosis of the tibia have neurofibromatosis, while this is almost never seen in congenital pseudarthrosis of the clavicle.Correct Answer: Both may present with tapered, atrophic bone ends at the pseudarthrosis

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1975. (1115) Q5-1475:

A 13-year-old boy has a left slipped capital femoral epiphysis which has displaced 75%. He is unable to bear weight on the limb. The other hip has no clinical or radiographic abnormalities. Your preferred treatment is which of the following:

1) Gentle reduction of the slip and fixation with a cannulated screw
3) Cuneiform osteotomy
2) Hip spica cast
5) Free vascularized fibular grafting
4) Subtrochanteric osteotomy

This is an unstable slip. It has a much higher chance of avascular necrosis than a stable slip. Since the degree of the slip will increase the shear forces across the healing physis and decrease the function of the hip, some method of improving this is justified. Gentle reduction of the epiphysis, without forceful internal rotation, may increase the risk of avascular necrosis. Avascular necrosis is a significant risk in many series of cuneiform (metaphyseal; Fish) osteotomies. Subtrochanteric osteotomy is not justified in patients with an acute slip until it is healed. It has a high rate of chondrolysis. Free vascularized bone graft may be an option if avascular necrosis develops, but is not indicated at this time. A hip spica cast is also often followed by chondrolysis and delayed epiphyseodesis.Correct Answer: Gentle reduction of the slip and fixation with a cannulated screw

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1976. (1116) Q5-1476:

Of all slipped capital femoral epiphyses, which percentage is unstable:

1) 5%
3) 25%
2) 15%
5) 50%
4) 35%

Unstable slipped capital femoral epiphysis places the patient at a high risk of avascular necrosis (up to 47%). Fortunately, it comprises only about 5% of all slips.Correct Answer: 5%

1977. (1117) Q5-1477:

The normal value for the hallux valgus angle is:

1) 0Â° to 5Â°
3) 10Â° to 20Â°
2) 5Â° to 10Â°
5) 30Â° to 40Â°
4) 20Â° to 30Â°

The angle between the first metatarsal and its proximal phalanx is normally one of mild (10Â° to 20Â°) valgus. It is not normal for it to be too straight. An increase in this angle beyond this value is often noted by the patient as a bunion.Correct Answer: 10Â° to 20Â°

1978. (1118) Q5-1478:

A 13-year-old girl is seen in clinic for bunion. She is asymptomatic but has a hallux valgus angle of 29Â°, an intermetatarsal angle of 15Â°, and a medial prominence over the first metatarsal head. The family asks whether anything can be done to prevent future problems with the foot. You recommend:

1) Osteotomy of the first metatarsal base
3) Double osteotomy of the first metatarsal
2) Hemiepiphyseodesis of the medial physis of the first metatarsal
5) Shoe modifications if symptoms develop
4) Mitchell osteotomy

Bunions may often be treated conservatively, and it is impossible to predict which ones will later develop symptoms. Surgical reconstruction of bunions in adolescents has a higher rate of recurrence than in adults in many reported series. For all of these reasons, nonoperative treatment is preferred for asymptomatic patients.Correct Answer: Shoe modifications if symptoms develop

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1979. (1119) Q5-1479:

Which of the following tendons is not usually contracted in a patient with untreated vertical talus:

1) Anterior tibialis
3) Peroneus brevis
2) Posterior tibialis
5) Achilles
4) Extensor digitorum longus

A vertical talus is a fixed dorsolateral dislocation of the talonavicular joint. The forefoot is in calcaneus and the hindfoot is in equinus. Therefore, all of the tendons listed except for the posterior tibialis are contracted.Correct Answer: Posterior tibialis

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1980. (1120) Q5-1480:

A 9-year-old boy is seen because of pain medially, in the arch of the foot. His ankle dorsiflexion is limited to 10Â° with the knee extended. Radiograph shows an accessory navicular, which corresponds to the point of his tenderness. You recommend:

1) Excision of the accessory navicular
3) Evans procedure (lateral column lengthening)
2) Excision of the accessory navicular with advancement of the posterior tibialis tendon
5) Activity restriction, stretching, arch support
4) Tendoachilles lengthening

Accessory navicular is seen in 10% to 14% of normal children. Sometimes, it becomes symptomatic in juveniles or adolescents, but this usually resolves by skeletal maturity. Conservative treatment, such as activity restriction, arch support, and stretching the Achilles if tight, will usually alleviate symptoms.Correct Answer: Activity restriction, stretching, arch support

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1981. (1121) Q5-1481:

Which of the following disorders is due to a defect in anterior horn cells:

1) Charcot-Marie-Tooth
3) Friedreichâs ataxia
2) Duchenne dystrophy
5) Rett syndrome
4) Spinal muscular atrophy

Charcot-Marie-Tooth disease is due to a defect in peripheral nerves; Duchenne muscular dystrophy is due to a defect in dystrophin, affecting the muscle cell membrane; Friedreich ataxia is a degeneration of the spinocerebellar tracts. Rett syndrome is due to a defect in MECP-2 protein, affecting the brain. *Only spinal muscular atrophy is due to a defect in anterior horn cells.*Correct Answer: Spinal muscular atrophy

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1982. (4041) Q5-1482:

Becker muscular dystrophy is due to a defect in the gene for which of the following:

1) Dystrophin
3) Myelin
2) Sarcoglycan
5) Fibroblast growth factor receptor
4) Sulfate transport

Becker muscular dystrophy has a defect in the same gene as Duchenne muscular dystrophy, namely the protein dystrophin. The mutation in Becker dystrophy results in a truncated protein that retains some function, whereas the mutation in Duchenne dystrophy is different and results in an unstable protein, which is degraded quickly.Correct Answer: Dystrophin

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1983. (1122) Q5-1483:

Which of the following muscles is first affected in facioscapulohumeral dystrophy:

1) Orbicularis oris
3) Deltoid
2) Serratus anterior
5) Infraspinatus
4) Supraspinatus

In facioscapulohumeral dystrophy, the facial muscles are affected first, commonly presenting with an inability to whistle. The serratus muscles and scapular stabilizers are affected next. The deltoid, supraspinatus, and infraspinatus are typically not affected in this disease.Correct Answer: Orbicularis oris

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1984. (1123) Q5-1484:

Emery-Dreifuss muscular dystrophy is unique among the dystrophies because of the development of which deformity:

1) Neck extension contracture
3) Knee flexion
2) Hip abduction
5) Scoliosis
4) Equinus contracture

Emery-Dreifuss muscular dystrophy is an x-linked disorder of emerin, which is a cell-membrane protein. Symptoms and signs develop within the first decade in most cases. A unique deformity, neck extension contracture, develops, in addition to elbow flexion contractures and peroneal wasting. The other deformities listed above are common in many dystrophies.Correct Answer: Neck extension contracture

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1985. (1124) Q5-1485:

Electrodiagnostic testing in myopathies typically shows all of the following except:

1) Low amplitude electromyogram (EMG) potentials
3) Normal nerve conduction velocity
2) Polyphasic EMG potentials
5) Fibrillation potentials
4) Decreased duration of EMG response

Electrodiagnostic testing in myopathy typically shows low amplitude, polyphasic EMG potentials with a decreased duration of response. Nerve conduction velocity is normal, in contrast to findings in neuropathies. Fibrillations are not typically seen; these are more characteristic of neuropathy.Correct Answer: Fibrillation potentials

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1986. (1125) Q5-1486:

In which region is direct anatomical extension from the metaphysis of a long bone to the adjacent joint not anatomically possible in the child:

1) Shoulder
3) Hip
2) Elbow
5) Ankle
4) Knee

The metaphysis of the proximal humerus lies partially within the shoulder joint; similarly, that of the proximal radius lies within the elbow. The metaphysis of the proximal femur lies within the hip joint and that of the distal lateral tibia within the ankle joint. *There is no intra-articular metaphysis about the knee, however.*Correct Answer: Knee

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1987. (1126) Q5-1487:

Which of the following skeletal dysplasias is not commonly associated with non-orthopedic complications:

1) McKusick metaphyseal chondrodysplasia
3) Morquio syndrome
2) Hurler syndrome
5) Multiple epiphyseal dysplasia
4) Chondroectodermal dysplasia

McKusick dysplasia is commonly associated with immune and gastrointestinal disorders. Hurler syndrome is associated with progressive mental retardation, hepatosplenomegaly, and cataracts. Morquio syndrome is associated with cardiorespiratory difficulties. Chondroectodermal dysplasia, or Ellis van Creveld syndrome, is associated with congenital heart disease. Multiple epiphyseal dysplasia, however, is not associated with systemic non-orthopaedic complications.Correct Answer: Multiple epiphyseal dysplasia

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1988. (1127) Q5-1488:

Which of the following by itself is not an indication for surgery in a child with acute hematogenous osteomyelitis:

1) Fever higher than 38.5Â°
3) Presence of a sequestrum
2) Subperiosteal abscess
5) Adjacent septic arthritis
4) Intramedullary abscess

Surgery is indicated in situations in which antibiotics alone will not be curative, including subperiosteal abscess, sequestrum, intramedullary abscess, and adjacent septic arthritis. Fever alone is not an indication for surgery.Correct Answer: Fever higher than 38.5Â°

1989. (1128) Q5-1489:

Which of the following is not usually seen in chronic recurrent multifocal osteomyelitis:

1) Positive cultures for Staphylococcus epidermidis
3) Involvement of the spine, long bones, and feet
2) Gradual onset of symptoms
5) Improvement with nonsteroidal anti-inflammatory agents
4) Negative cultures

Chronic recurrent multifocal osteomyelitis is believed to be an idiopathic noninfectious inflammatory disease. It has gradual onset of symptoms, and sites most commonly involved are the spine, long bones, and feet. Nonsteroidal anti-inflammatory drugs typically improve symptoms. Cultures are negative.Correct Answer: Positive cultures for Staphylococcus epidermidis

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1990. (1129) Q5-1490:

A 5-year-old child is bitten by a tick. Which of the following has been shown to aid in management:

1) Prompt tick removal
3) Immediate treatment with amoxicillin
2) Immediate treatment with doxycycline
5) Steroid administration
4) Prompt ELISA testing

Prompt tick removal is recommended because Lyme disease is more likely if the tick is attached for more than 24 hours. Immediate antibiotic administration is not recommended because the incidence of Lyme disease is low after any single tick bite and treatment is equally effective once the disease is diagnosed. Doxycycline is not recommended in children younger than 8 years old because of dental discoloration. Immediate testing for antibodies (ELISA) is not useful because antibodies do not rise for at least several weeks. Steroids are not recommended in this setting.Correct Answer: Prompt tick removal

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1991. (1130) Q5-1491:

Which of the following measures has not been shown to decrease rates of injury in healthy children participating in recreational sports:

1) Knee braces during basketball and football
3) Helmets for bicyclists
2) Ankle braces in basketball
5) Break-away bases for baseball
4) Mouth guards for basketball

Knee braces have been shown not to reduce injury rates for children for children with sound knees. All other measures have been shown to reduce injury rates.Correct Answer: Knee braces during basketball and football

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1992. (1131) Q5-1492:

Which recreational activity causes the most musculoskeletal injuries in children ages 5 to 14 in the United States:

1) Bicycles
3) Soccer
2) Football
5) Gymnastics
4) Trampolines

Bicycles are the leading cause of musculoskeletal injury in American children, with 415,000 injuries per year, followed by basketball, football, and roller sports.Correct Answer: Bicycles

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1993. (1173) Q5-1538:

The effects of pediatric orthopedic conditions in later adulthood commonly determine treatment choices for children. At what threshold does limb length discrepancy increase the energy cost of walking in older adults:

1) 2 cm
3) 4 cm
2) 3 cm
5) No such effect has been proven at any discrepancy.
4) 5 cm

A limb length discrepancy of as little as 2 cm has shown to increase perceived exertion as well as oxygen consumption in older adults.Correct Answer: 2 cm

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1994. (1174) Q5-1539:

Anterior elbow release in children with cerebral palsy is likely to result in which of the following outcomes:

1) Decreased flexion posture during use
3) Increased use during bimanual activity
2) Decreased flexion contracture
5) Increased grip strength
4) Increased strength of elbow flexion

Anterior elbow release consists of lengthening of the lacertus fibrosus and the brachialis fascia. It may or may not include lengthening of the biceps tendon itself. Anterior elbow release effectively decreases the excessive flexion posture of the elbow during use, which one author has termed the âflexion posture angle.â It does not result in decreased (or increased) strength of elbow flexion if the biceps tendon is preserved. Unfortunately, increased use during bimanual activity and increased grip strength are usually not observed.Correct Answer: Decreased flexion posture during use

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1995. (1175) Q5-1540:

Which of the following procedures is most likely to correct idiopathic toe walking with a single treatment:

1) Stretching program
3) Stretching cast
2) Ankle foot orthosis
5) Percutaneous tendoachilles lengthening
4) Botulinum toxin injection

Percutaneous tendoachilles lengthening is most likely to resolve idiopathic toe walking in a single treatment. The other methods have a higher likelihood of persistent toe walking.Correct Answer: Percutaneous tendoachilles lengthening

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1996. (1176) Q5-1541:

Core binding factor alpha 1 (Cbfa1) is a transcription factor having which of the following effects:

1) Cbfa1 induces cells to differentiate into osteoblasts.
3) Cbfa1 inhibits endochondral ossification.
2) Cbfa1 induces cells to differentiate into osteoclasts.
5) Cbfa1 causes premature cell death.
4) Cbfa1 impairs sulfation of proteoglycans.

Cbfa1 is a transcription factor that causes cells to differentiate into osteoblasts. An abnormality in its gene causes cleidocranial dysplasia.Correct Answer: Cbfa1 induces cells to differentiate into osteoblasts.

1997. (1177) Q5-1542:

Which of the following is found less often in children with lumbosacral agenesis as compared to controls:

1) Cervical spine anomalies
3) Hip dislocation
2) Maternal diabetes
5) Genu recurvatum
4) Spina bifida

Patients with lumbosacral agenesis often have knee flexion contractures as compared with controls. All of the other features listed are common in patients with lumbosacral agenesis.Correct Answer: Genu recurvatum

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1998. (1178) Q5-1543:

Which of the following figures most closely approximates the prevalence of defects in the L5 pars interarticularis in a newborn:

1) Less than 1%
3) 5%
2) 3%
5) 15%
4) 10%

Pars interarticularis defects are not found in newborns, whereas the incidence is 5% in patients who are in the first grade. It remains close to this figure throughout later life.Correct Answer: Less than 1%

1999. (1179) Q5-1544:

Which of the following is the most common cause of low back pain in young athletes:

1) Thoracolumbar Scheuermann apophysitis
3) Slipped vertebral apophysis
2) Herniated nucleus pulposus
5) Avulsion of the spinous apophysis
4) Spondylolysis

Spondylolysis is the most common cause of back pain in young athletes, accounting for approximately 50% of cases. The other causes are significantly less common.Correct Answer: Spondylolysis

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2000. (1180) Q5-1545:

A 7-year-old boy with cerebral palsy, total involvement type, has neuromuscular hip dysplasia. The migration index is 60% without flattening. He has had pain in the groin for the past 6 months. Recommended treatment includes:

1) Adductor tenotomy
3) Proximal femoral resection
2) Adductor tenotomy and femoral osteotomy
5) Total hip arthroplasty
4) Hip arthrodesis

Pain in the spastic patient with subluxation without head deformity is most appropriately treated by reduction. Adductor tenotomy alone is not recommended when the hip subluxation exceeds 50% or the age is greater than 5 to 6 years. Femoral osteotomy should be added. Salvage procedures such as proximal femoral resection, arthrodesis, or arthroplasty are not indicated.Correct Answer: Adductor tenotomy and femoral osteotomy

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2001. (1181) Q5-1546:

The Ponseti method of clubfoot cast treatment starts with which of the following steps:

1) Pronation of the forefoot
3) Dorsiflexion of the ankle
2) Dorsiflexion of the first ray
5) Internal rotation of the foot
4) External rotation of the foot

Dorsiflexion of the first ray is the first step in the Ponseti method of cast treatment. Dorsiflexion decreases the cavus component.

- Pronation of the forefoot is the opposite of dorsiflexion and produces the opposite desired motion.
- Dorsiflexion of the ankle should be performed after the Achilles tenotomy.
- External rotation of the foot is performed later.
- Internal rotation of the clubfoot is never done.

Correct Answer: Dorsiflexion of the first ray

2002. (1182) Q5-1547:

When correcting a clubfoot by the Ponseti method, the lateral mold on the foot must be placed against which of the following structures:

1) The head of the talus
3) The cuboid
2) The calcaneus
5) The tibia
4) The fifth metatarsal

Ponseti describes rotating the clubfoot against the head of the talus to allow the lateral side of the foot (calcaneus and cuboid) to rotate laterally.Correct Answer: The head of the talus

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2003. (1183) Q5-1548:

Which of the following molecules is defective in osteogenesis imperfecta:

1) Type I collagen
3) Calcium transport channels
2) Type II collagen
5) Renal tubular reabsorption of phosphate
4) Vitamin D 1,25-dihydroxylase

Osteogenesis imperfecta (OI) is a disorder of type I collagen. Numerous different mutations in the genes for this molecule have been described, accounting for the variable clinical phenotypes. Type II collagen is important for articular cartilage, but it is not implicated in the pathogenesis of OI. The other factors are not abnormal in OI.Correct Answer: Type I collagen

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2004. (1184) Q5-1549:

Regulation of proximal-to-distal development of the limbs is determined by which of the following:

1) Fibroblast growth factor gene
3) Platelet-derived growth factor gene
2) Homeobox genes
5) Sulfate transport gene
4) Leptin gene

Proximal-to-distal development of the limbs in utero is determined by the homeobox genes. These genes are located on a number of different chromosomes (2, 7, 12, and 17), and they guide the proximal-to-distal organization of limb and digital development.Correct Answer: Homeobox genes

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2005. (1185) Q5-1550:

Meryon sign refers to which of the following physical phenomena in patients with muscular dystrophies:

1) Wide-based gait
3) Tendency to âslip throughâ when patient is suspended under the axillae
2) Use of upper extremities in coming to stand
5) Inability to fully flex the neck
4) Absence of facial expression

Meryon sign is the weakness of shoulder adduction when a child is lifted or suspended under the axillae. The examiner will feel that the child is slipping through his or her hands. It is due to weakness of the shoulder girdle muscles. Meryon sign is present in limb-girdle dystrophies and fascioscapulohumeral dystrophy.Correct Answer: Tendency to âslip throughâ when patient is suspended under the axillae

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2006. (1186) Q5-1551:

Spinal muscular atrophy is best characterized as which of the following:

1) An upper motor neuropathy
3) A sensory neuropathy
2) A lower motor neuropathy
5) A generalized myopathy
4) A peripheral neuropathy

Spinal muscular atrophy is a degeneration of the anterior horn cells of the spinal cord. It results in a nonprogressive lower motor neuron disease with preservation of sensation and intelligence. There is no spasticity or hyperreflexia.Correct Answer: A lower motor neuropathy

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2007. (1187) Q5-1552:

Which of the following is the gene that is abnormal in spinal muscular atrophy:

1) Survival motor neuron genes 1 and 2
3) Gene for frataxin
2) Gene for dystrophin
5) Gene for emerin
4) Gene for peripheral myelin protein

Spinal muscular atrophy is a disorder of survival motor neuron genes 1 and 2; its product is not yet known.

- Dystrophin is abnormal in Duchenne and Becker muscular dystrophy.
- Frataxin is abnormal in Friedreich ataxia.
- Peripheral myelin protein is defective in Charcot-Marie-Tooth disease.
- Emerin is abnormal in Emery-Dreifuss syndrome.

Correct Answer: Survival motor neuron genes 1 and 2

2008. (1188) Q5-1553:

Emery-Dreifuss syndrome is manifest by all of the following except:

1) Heel cord contractures
3) Limited cervical flexion
2) Elbow contractures
5) Cardiomyopathy
4) Scoliosis

Emery-Dreifuss syndrome is due to an encoding error in emerin, which may be a stabilizer of the nuclear membrane. Emery-Dreifuss syndrome is characterized by a triad of contractures of the heel cord, elbow, and cervical spine. Cardiomyopathy may cause heart block or other arrhytmias. Scoliosis is not commonly found in this condition.Correct Answer: Scoliosis

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2009. (1189) Q5-1554:

Which of the following bones of the foot is normally ossified at birth:

1) Cuboid
3) Third cuneiform
2) First cuneiform
5) First metatarsal
4) Navicular

The metatarsals are ossified at birth, along with the talus and the calcaneus.

- The cuboid ossifies at 1 month, followed by the third, second, and first cuneiforms.
- The navicular does not ossify until age 2 or 3 years.

These facts are useful when interpreting radiographs for congenital foot deformities such as clubfoot. The location of the navicular must often be inferred from the position of the first metatarsal.Correct Answer: First metatarsal

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2010. (1190) Q5-1555:

Chronic recurrent multifocal osteomyelitis is caused by which of the following:

1) *Staphylococcus epidermidis*
3) Spirochetal infection
2) *Corynebacterium*
5) No organism has been isolated
4) Viral infection

Chronic recurrent multifocal osteomyelitis presents as chronic joint pain at multiple locations and at different times. No organism has been isolated from patients presenting with chronic recurrent multifocal osteomyelitis. There is no role for surgery or antibiotics because symptoms generally resolve over a period of time.Correct Answer: No organism has been isolated

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2011. (1191) Q5-1556:

A 5-year-old boy has midfoot pain and limps at the end of long walks. Radiographs show sclerosis and fragmentation of the navicular on the involved side. Recommended treatment is:

1) Core decompression
3) Electrical stimulation
2) Activity modification
5) Talonaviculocuneiform fusion
4) Bone grafting of the ossific nucleus of the navicular

Kohlerâs disease, or avascular necrosis of the tarsal navicular, occurs spontaneously. It is more common in boys than girls, and it frequently presents before the age of 8 years. Conservative treatment consisting of counseling and activity modification is usually sufficient, with reossification ensuing. Occasionally cast immobilization seems helpful in allaying symptoms.Correct Answer: Activity modification

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2012. (1192) Q5-1557:

An 11-year-old girl presents with pain in the area of the second metatarsophalangeal joint. Pain is increased with joint motion. Radiographs show increased density and flattening of the metatarsal head. Recommended treatment is:

1) Core decompression
3) Bone graft of the epiphysis of the second metatarsal
2) Decreased activity and use of orthotics
5) Osteotomy of the second metatarsal neck
4) Fusion of the metatarsophalangeal joint in a functional position

Freibergâs disorder, or osteochondrosis of the second metatarsal head, is most common in teenage girls, especially dancers. The length of this metatarsal may be a factor in the pathogenesis. Treatment must be conservative in most cases, although a mild degree of symptoms may persist if epiphyseal flattening does not remodel.Correct Answer: Decreased activity and use of orthotics

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2013. (1193) Q5-1558:

Which of the following complications is not a recognized risk of the Salter osteotomy:

1) Recurrent subluxation
3) Pin infection
2) Pin migration
5) Migration of the bone graft
4) Avascular necrosis

Avascular necrosis is not a risk of the osteotomy, but rather of an open or closed reduction that may sometimes accompany it. All of the other complications are accepted as possible, although rare, sequelae of the procedure.Correct Answer: Avascular necrosis

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2014. (1194) Q5-1559:

The result of treatment of developmental dysplasia of the hip with Salter osteotomy is is worse with which of the following:

1) A higher degree of the dislocation before treatment (Tonnis grade)
3) Higher preoperative acetabular index
2) Bilaterality
5) Performing open reduction at a separate surgery than the osteotomy
4) Increased age at surgery

Salter osteotomy is effective in treating developmental dysplasia of the hip in young children. The result is worse with higher degrees of dislocation as assessed by the Tonnis system. It is better if the open reduction (if needed) is performed as a separate step than the osteotomy. The other factors have not been shown to be predictive.Correct Answer: A higher degree of the dislocation before treatment (Tonnis grade)

2015. (1195) Q5-1560:

A 4-year-old girl with developmental hip dysplasia is advised to have a Salter innominate osteotomy. When the family asks about the long-term survivorship of the reconstruction, the surgeon tells them that good 30-year follow-up results are likely in at least what percentage of patients:

1) 30%
3) 70%
2) 50%
5) 98%
4) 85%

Thirty-year survivorship analysis shows good to excellent results in at least 85% of patients.Correct Answer: 85%

2016. (1196) Q5-1561:

Which of the following statements best describes the effect of leptin on the skeleton:

1) Leptin increases bone formation.
3) Leptin decreases bone formation.
2) Leptin increases muscle mass.
5) Leptin increases longitudinal growth.
4) Leptin decreases muscle mass.

Leptin is a polypeptide secreted by adipocytes and acts upon the hypothalamus as a powerful inhibitor of bone mass.Correct Answer: Leptin decreases bone formation.

2017. (1197) Q5-1562:

Which of the following organisms is the most common cause of obturator internus muscle abscess in children:

1) *Streptococcus A*
3) *Salmonella*
2) *Staphylococcus aureus*
5) *Pseudomonas aeruginosa*
4) *Escherichia coli*

Abscess of the obturator internus muscle may mimic septic arthritis. It is best diagnosed by magnetic resonance image. <1>Staphylococcus aureus is the most common causative organism, accounting for 75% of cases of obturator internus muscle abscess. Antibiotic treatment should be tried first and is successful in most cases.Correct Answer: *Staphylococcus aureus*

2018. (1198) Q5-1564:

Which of the following studies is likely to help in distinguishing osteomyelitis from infarct in a patient with sickle cell anemia:

1) Magnetic resonance imaging
3) Bone and bone marrow scans
2) Computed tomography
5) Plain radiographs
4) Ultrasound

The combination of bone and bone marrow scan is the only imaging method that is useful in distinguishing osteomyelitis from infarct in patients with sickle cell anemia. The bone marrow scan is normal, but the bone scan shows increased uptake in a patient with osteomyelitis.Correct Answer: Bone and bone marrow scans

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2019. (1199) Q5-1565:

A 10-year-old boy with diplegic cerebral palsy walks with his knees turned in significantly. He has the appearance of severe valgus when walking. When examined in a supine position, there is no excessive valgus of the knees. His popliteal angle is 45Â°. An Ely test is negative. His hip internal rotation in the prone position is 80Â°, while his external rotation is 15Â°. The surgeon wishes to improve the patientâs knee position during gait. The intervention most likely to accomplish this is:

1) Botulinum toxin injection to the hamstrings
3) Hamstring lengthening, medially and laterally
2) Hamstring lengthening, medially
5) Femoral derotation osteotomy
4) Rectus transfer into the biceps

The findings highlighted here are those of severe anteversion. Anteversion causes the appearance of valgus of the knees, and it does not resolve spontaneously in cerebral palsy. The procedure most likely to make a lasting improvement in the patient is derotational osteotomy of the femur.Correct Answer: Femoral derotation osteotomy

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2020. (1200) Q5-1566:

Which of the following procedures is most likely to increase recurvatum of the knee in patients with diplegic cerebral palsy:

1) Medial hamstring lengthening
3) Rectus transfer to the hamstrings
2) Medial and lateral hamstring lengthening
5) Adductor lengthening
4) Tendoachilles lengthening

Lengthening of the medial and lateral hamstrings is more likely to overlengthen the posterior knee checkrein. Therefore, it should only be performed in selected cases with severe spasticity and no cospasticity of the rectus femoris. Lengthening of only the medial hamstrings carries less risk. The other procedures listed do not carry this risk.Correct Answer: Medial and lateral hamstring lengthening

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2021. (1201) Q5-1567:

A 7-year-old boy has short stature, unilateral coxa vara, and lack of ossification in the medial pubic rami. The most likely diagnosis is:

1) Achondroplasia
3) Osteogenesis imperfecta
2) Diastrophic dysplasia
5) Multiple epiphyseal dysplasia
4) Cleidocranial dysplasia

Cleidocranial dysplasia produces the above findings, in addition to partial or complete lack of formation of the clavicles and persistent widening of the cranial fontanelles. None of these findings are present in the other conditions.Correct Answer: Cleidocranial dysplasia

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2022. (1362) Q5-1732:

An 11-year-old girl injures her knee while playing lacrosse and develops a hemarthrosis. The most likely diagnosis is:

1) Anterior cruciate ligament tear
3) Physeal injury of the distal femur
2) Patellar dislocation
5) Medial meniscus tear
4) Tibial spine avulsion

The most common cause of hemarthrosis of the knee in skeletally immature patients is a patellar dislocation. Anterior cruciate ligament injuries and tibial spine avulsions are less common. Medial meniscus tears are extremely rare in this population.Correct Answer: Patellar dislocation

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2023. (1363) Q5-1733:

In order to see the articular cartilage of the knee in a child who has knee trauma, a magnetic resonance image must include:

1) T1-weighted images
3) Gradient echo sequences
2) T2-weighted images
5) Flexion and extension images
4) Gadolinium contrast

Articular cartilage may be injured during trauma to the knee and manifest as either osteochondral fractures or osteochondritis dissecans. The articular cartilage is best visualized using gradient echo sequences. Examples of this technique include fast low-angle shot (FLASH) imaging, fast imaging with steady precession (FISP), and short tau inversion recovery (STIR).Correct Answer: Gradient echo sequences

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2024. (1364) Q5-1734:

For a patient who has thoracic idiopathic scoliosis of the surgical range, the distance between the thecal sac and the apical thoracic pedicle on the concave side is:

1) Less than 1 mm
3) 3 mm
2) 2 mm
5) 5 mm
4) 4 mm

The distance between the apical thoracic pedicle and the thecal sac is less than 1 mm on the concave side.Correct Answer: Less than 1 mm

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2025. (1365) Q5-1735:

Which region (vertebral body) of the spine is the closest to the aorta:

1) T4
3) T1
2) T9
5) T12
4) T6

The aorta is on the left side of the vertebra in the upper and midthoracic spine. The aorta moves to an anterior location in the lower thoracic spine. The distance from the aorta to the vertebral body is 6 mm to 7 mm in skeletally mature patients with idiopathic scoliosis between the fourth and ninth vertebral bodies. The distance becomes less than 5 mm in the thoracolumbar junction and lumbar spine. The aortic arch does not extend to the first thoracic vertebral.Correct Answer: T12

2026. (1366) Q5-1736:

The width of the pedicles in a patient with idiopathic scoliosis in the surgical range is narrowest in the:

1) Thoracic spine on the convex side
3) Sacral spine
2) Lumbar spine on the convex side
5) Lumbar spine on the concave side
4) Thoracic spine on the concave side

The width of the pedicles is less in the thoracic spine than in the lumbar or sacral spine, and less on the concavity than on the convexity. The mean width of the thoracic pedicles on the concave side at the apex in skeletally mature patients is only 3 mm.Correct Answer: Thoracic spine on the concave side

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2027. (1367) Q5-1737:

The angle of the pedicle with the midsagittal plane at T11 is closest to:

1) 0Â°
3) 15Â°
2) 5Â°
5) 25Â°
4) 20Â°

The angle of the pedicles is greatest in the upper thoracic and lumbar spines (approximately 15Â°). The angle decreases to approximately 7Â° at the thoracolumbar junction.Correct Answer: 5Â°

2028. (4042) Q5-1738:

Which of the following is not a common finding in the forearms of patients who have multiple hereditary exostoses:

1) Radial head subluxation or dislocation
3) Decreased slope of the distal radial articular surface
2) Limitation of rotation
5) Decreased length of the ulna
4) Subluxation of the carpus toward the ulna

Multiple hereditary exostosis is characterized by differential growth of the two bones. There is often decreased length of the ulna. This results in increased inclination of the distal radial articular surface, radial head subluxation, and subluxation of the carpus toward the ulna. The exostoses themselves may block rotation.Correct Answer: Decreased slope of the distal radial articular surface

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2029. (1368) Q5-1739:

Which of the following factors has proven to increase the risk of degenerative disease of the wrist in patients with multiple hereditary osteochondromas:

1) Ulnar negative variance of 5 mm
3) Distal radial articular slope larger than 25Â°
2) Ulnar negative variance of 10 mm
5) None of the above
4) Subluxation of the radial head

The above findings are all more common in the forearms and wrists of patients with multiple hereditary exostoses than in the general population. However, there is no parameter shown to increase the risk of degenerative wrist disease.Correct Answer: None of the above

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2030. (1369) Q5-1740:

Which adverse outcome is most common in adults undergoing periacetabular osteotomy for hip dysplasia:

1) Sciatic nerve palsy
3) Nonunion of the osteotomy
2) Femoral nerve palsy
5) Heterotopic ossification
4) Persistent or worsening joint pain

Heterotopic ossification occurs in fewer than 5% of patients undergoing various types of periacetabular osteotomy. Femoral nerve palsy and sciatic nerve palsy occur in only 1% to 2% of patients. Nonunion is rare in this region because of abundant cancellous bone contact. Persistent or worsening joint pain is the most frequent adverse outcome and is least common in those patients with preoperative degenerative changes.Correct Answer: Persistent or worsening joint pain

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2031. (1370) Q5-1741:

An 18-year-old woman complains of pain in her groin area. An anteroposterior radiograph reveals a dysplastic hip with a center-edge angle of 0Â°. The femoral head is spherical and centers better on abduction. There is a cyst in the superior acetabulum. The joint space is narrowed superiorly by 1 mm. Recommended treatment includes:

1) Salter innominate osteotomy
3) Pemberton osteotomy
2) Total hip arthroplasty
5) Periacetabular osteotomy
4) Hip arthrodesis

This patient has a high likelihood of progressive hip deterioration so surgery is warranted. The periacetabular osteotomy is preferred because the procedure can correct this high degree of hip dysplasia. The Salter osteotomy, which hinges the hemipelvis on the symphysis pubis, cannot reliably correct more than 10Â° of dysplasia in this age group. The Pemberton osteotomy relies on plasticity of the immature skeleton to âfoldâ the pelvis on an open triradiate cartilage, therefore, it is not indicated in an 18-year-old woman who is skeletally mature. Hip arthrodesis is not indicated when there are other, better options. The same can be said for total hip arthroplasty due to the finite duration of fixation in a young person.Correct Answer: Periacetabular osteotomy

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2032. (1371) Q5-1742:

A high school basketball player dies suddenly during a game. Which of the following is the least likely cause of death:

1) Hypertrophic cardiomyopathy
3) Aortic dissection from Marfan syndrome
2) Prolonged Q-T interval
5) Substance abuse
4) Coronary artery anomalies

Hypertrophic cardiomyopathy, coronary artery anomalies, and electrical abnormalities are the most common causes of sudden death in athletes. Substance abuse is also common. Marfan syndrome, which can be heralded by skeletal features of arachnodactyly, should also be considered when screening athletes although it is not as likely as the other choices to cause death.Correct Answer: Aortic dissection from Marfan syndrome

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2033. (1372) Q5-1743:

A 15-year-old girl has anterior hip pain and she tells you that she hears periodic snapping or clicking. Bringing the hip from the flexed-abducted position to the extended position reproduces the pain. Radiographs are normal. The diagnosis is most likely:

1) Trochanteric bursitis
3) Snapping psoas tendon
2) Acetabular dysplasia
5) Femoral hernia
4) Torn acetabular labrum

Snapping of the psoas tendon is more common in girls than boys. A snapped psoas tendon is characterized by anterior hip pain that can be reproduced by moving the hip from a figure 4 position to an extended position. The discomfort from trochanteric bursitis is located laterally. The symptoms of an abnormality in the labrum or the acetabulum are not associated with snapping.Correct Answer: Snapping psoas tendon

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2034. (1373) Q5-1744:

A 15-year-old girl has a snapping psoas tendon. Abducting and adducting her hip reproduces symptoms of anterior hip pain. Her pain has not been relieved by rest and stretching. The next step of treatment is:

1) Excising the bursa
3) Intramuscular lengthening of the tendon
2) Releasing the hip from the lesser trochanter
5) Excising the pectineal eminence
4) Transferring the psoas tendon to the neck of the femur

The initial treatment of snapping psoas tendon is rest, antiinflammatory agents, and stretching. If symptoms remain significant, the next measure to offer the patient is intramuscular lengthening of the tendon.Correct Answer: Intramuscular lengthening of the tendon

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2035. (1374) Q5-1745:

A 4-year-old girl is newly diagnosed with developmental dislocations of the hips. The femoral heads are fully dislocated and located 4 cm above the acetabulum. No pseudoacetabulum is seen. Recommended treatment includes:

1) No treatment
3) Open reduction through a medial approach
2) Traction and closed reduction
5) Open reduction through an anterolateral approach with femoral and iliac osteotomies
4) Closed reduction and Salter osteotomy

At the age of 4, femoral shortening is indicated to remove the pressure on the reduced femoral head. Realignment of the bony dysplasia is achieved by femoral derotation, iliac redirection, and possible creation of varus in the proximal femur. Open reduction through a medial approach is an option during the first 2 years, but after that the anterolateral approach is preferred in order to create a stable capsulorrhaphy.Correct Answer: Open reduction through an anterolateral approach with femoral and iliac osteotomies

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2036. (1375) Q5-1746:

A 3-year-old boy falls from a swing and injures his elbow. Radiographs show posteromedial displacement of the radius and ulna. A small fleck of bone is viewed on the radiograph that does not match the contralateral elbow. The most likely diagnosis is:

1) Elbow dislocation
3) Lateral condyle fracture with elbow dislocation
2) Salter I disruption of the distal humerus
5) Radial head fracture dislocation
4) Supracondylar fracture of the humerus

Isolated elbow dislocations are rare in very young children because the epiphysis is mostly cartilaginous. Supracondylar fractures usually occur at an older age and have an obvious fracture line. A Salter I injury does not have an osseous component. A radial head fracture-dislocation would not explain the disruption of the ulna-humerus articulation. A lateral condyle fracture-dislocation is the most likely diagnosis in this patient.Correct Answer: Lateral condyle fracture with elbow dislocation

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2037. (1376) Q5-1747:

A 6-month-old baby is brought in for consultation because of bowing of the tibia and fibula. The apex of the bow is medial and posterior. The angulation measures 40Â° on the anteroposterior film and 35Â° on the lateral film. One of the babyâs legs is 1.5 cm shorter than the other one. Recommended treatment includes:

1) Manipulation and cast application
3) Osteotomy and intramedullary rod fixation
2) Osteoclasis
5) Observation
4) Osteotomy and lengthening

Posteromedial bowing of the tibia is not likely to go on to fracture. In most cases, the bowing resolves with growth. The length inequality remains proportionate throughout growth. No treatment is indicated at this time. Length equalization by standard means is indicated near maturity.Correct Answer: Observation

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2038. (1377) Q5-1748:

Which of the following bone lesions is shown to improve radiographically and clinically by use of systemic medication:

1) Aneurysmal bone cyst
3) Multiple exostoses
2) Unicameral bone cyst
5) Fibrous cortical defect
4) Fibrous dysplasia

In patients with polyostotic fibrous dysplasia, there is a decrease in pain and fracture rate and an improvement in radiodensity through the use of bisphosphonates. None of the other lesions mentioned respond radiographically to systemic medication.Correct Answer: Fibrous dysplasia

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2039. (1378) Q5-1749:

Polyostotic fibrous dysplasia is caused by a mutation in which of the following genes:

1) GNAS 1
3) Fibroblast growth factor receptor protein
2) EXT 1
5) COL1A1
4) CFBA1

Fibrous dysplasia is due to a postzygotic mutation in the GNAS1 gene. By contrast, EXT 1 mutations can cause multiple exostoses, and fibroblast growth factor receptor protein mutations cause achondroplasia, among other disorders. CFBA1 mutations are responsible for cleidocranial dysplasia. COL1A1 mutations are responsible for osteogenesis imperfecta.Correct Answer: GNAS 1

2040. (1379) Q5-1750:

An 18-year-old man has a lesion of the distal femur. The femoral cortex is expanded and thinned but has no periosteal reaction. Internally, there are septations and multiple fluid-fluid levels. The most likely diagnosis is:

1) Unicameral bone cyst
3) Parosteal osteosarcoma
2) Aneurysmal bone cyst
5) Fibrous cortical defect
4) Classic osteogenic sarcoma

The presence of all of these findings is most consistent with aneurysmal bone cyst. The fluid-fluid levels represent settling of red blood cells. Unicameral bone cysts do not contain these findings. Parosteal osteosarcomas are surface lesions. Classic osteosarcomas usually produce periosteal reaction and not much expansion of the bone. Fibrous cortical defects produce none of the above.Correct Answer: Aneurysmal bone cyst

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2041. (1380) Q5-1751:

A 17-year-old girl is newly diagnosed with an expansile lesion of the distal tibia that is causing pain. Radiographs and biopsy are consistent with an aneurysmal bone cyst. Recommended treatment includes:

1) Intralesional steroid injection
3) Curettage and bone graft
2) Intralesional bone marrow injection
5) Local radiation
4) Wide resection distal tibial osteoarticular allograft

Aneurysmal bone cyst is a progressively expansile lesion that does not involute with time. Treatment of aneurysmal bone cysts is curettage and bone graft. Wide resection and structural allografts have a high complication rate and are not indicated for initial treatment. Injection of marrow or steroids is effective for unicameral cysts, but not for aneurysmal cysts. Local radiation is indicated only as an adjunct for lesions that are not surgically resectable.Correct Answer: Curettage and bone graft

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2042. (1381) Q5-1752:

Platelet calmodulin levels correlate with which of the following phenomena:

1) Progressive adolescent idiopathic scoliosis
3) Progressive slipped capital epiphysis
2) Progressive Scheuermann kyphosis
5) Progressive clubfoot
4) Bilateral Legg-Perthes disease

Platelets contain actin and myosin and, therefore, have some features similar to skeletal muscle. Calmodulin is a calcium-binding receptor protein that regulates intracellular calcium. Platelet calmodulin levels are increased in progressive adolescent idiopathic scoliosis.Correct Answer: Progressive adolescent idiopathic scoliosis

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2043. (1382) Q5-1753:

The proximal humerus is the most common location of unicameral bone cysts. Which of the following is the second most common location:

1) Distal radius
3) Proximal femur
2) Iliac wing
5) Proximal tibia
4) Distal femur

The proximal femur is the second most common location for unicameral bone cysts. All other locations are distinctly less common.Correct Answer: Proximal femur

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2044. (1383) Q5-1754:

An 8-year old patient presents with pain in a unicameral bone cyst of the proximal femur. Which of the following treatments is most likely to prevent fracture:

1) Intralesional steroid injection
3) Intralesional injection of demineralized bone matrix
2) Intralesional bone marrow injection
5) Curettage, bone graft, and internal fixation
4) Curettage and bone graft

Injection of any substance has a risk of recurrence, even if the injection is repeated. Bone graft has a risk as well, but internal fixation decreases the risk of fracture.Correct Answer: Curettage, bone graft, and internal fixation

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2045. (1384) Q5-1755:

All of the following are common in McCune-Albright syndrome except:

1) Precocious puberty
3) CafÃ©-au-lait spots
2) Polyostotic fibrous dysplasia
5) Multiple osteocartilaginous exostoses
4) Bowing of long bones

McCune-Albright syndrome consists of polyostotic fibrous dysplasia, precocious puberty, and cafÃ©-au-lait spots. Long bone deformity is almost universal. Multiple osteocartilaginous exostoses are not part of this syndrome.Correct Answer: Multiple osteocartilaginous exostoses

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2046. (1385) Q5-1756:

Which of the following is most likely to minimize bowing of the femora over the long term in a young patient with polyostotic fibrous dysplasia:

1) Bisphosphonates treatment
3) Application of allografts to lesions
2) Curettage and autograft packing of lesions
5) Injection of demineralized bone graft
4) Internal metal fixation

Bowing of the femora is a major problem for patients with polyostotic fibrous dysplasia. Bisphosphonates can decrease bone pain and increase bone density somewhat, but they do not prevent bowing. Allograft, autograft, and demineralized matrix are rapidly resorbed in most cases. Internal fixation with metal provides the best long-term protection.Correct Answer: Internal metal fixation

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2047. (1386) Q5-1757:

Which of the following factors is not associated with increased risk for progressive slippage after internal fixation of slipped capital femoral epihysis:

1) Acute component
3) Cushing disease
2) Hyperthyroidism
5) Male gender
4) Persistent pain after fixation

All of the factors listed, except gender, have been implicated in cases with increased progression of slipped capital femoral epiphysis even after pinning. Patients with these factors need close follow-up with a prolonged period of nonweightbearing or redirectional osteotomies.Correct Answer: Male gender

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2048. (1387) Q5-1758:

Femoral anteversion is defined as the angle in the transverse plane between the femoral neck and which distal anatomical reference point:

1) The lesser trochanter
3) The posterior femoral condylar plane
2) The femoral shaft
5) The tibial plateau
4) The distal femoral condylar plane

Anteversion of the femur is a measure of its rotation in the transverse plane. It is defined as the angle between the plane containing the femoral head/neck and that containing the femoral condyles. Anteversion declines from approximately 25Â° in infancy to approximately 15Â° at maturity.Correct Answer: The distal femoral condylar plane

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2049. (1388) Q5-1759:

The phenomenon of spinal cord injury without radiographic abnormality in children may be due to any one of the following except:

1) Increased longitudinal stretch of the skeletal elements compared to the spinal cord
3) Apophyseal injury
2) Increased physiologic translation of the cervical vertebrae
5) Lack of neural myelination in children
4) Transverse ligament injury of the atlas

In most cases, spinal cord injury without radiographic abnormality, or SCIWORA, is due to the greater elasticity or translation of the skeletal elements. Apophyseal or transverse ligament injuries are other explanations. Myelination of the cord is complete after birth so this is not an explanation.Correct Answer: Lack of neural myelination in children

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2050. (1389) Q5-1760:

A 6-year-old girl is seriously injured in an automobile accident. She remains unconscious and intubated 6 days after the injury due to head and pulmonary injuries. She is expected to survive. A firm cervical collar was placed on her neck at the time of rescue and remains in place. Plain radiographs show no cervical abnormalities. At this time, recommended treatment includes:

1) Removing the collar
3) Passive flexion and extension radiographs by the physician to clear the spine of injury
2) Leaving the collar in place until she awakens
5) Magnetic resonance imaging to clear the spine of injury
4) Ultrasound of the cervical spine to clear it of injury

Spinal cord injury without radiographic abnormality (SCIWORA) may occur in children. Motor vehicle accidents and head injury are two risk factors for this. The neck collar cannot be left on indefinitely or it may cause pressure sores. Therefore, it is most prudent to evaluate the cervical spine with magentic resonance imaging if the patientâs neck cannot be cleared by physical exam. Passive range of the neck is risky, and ultrasound is not used for this purpose.Correct Answer: Magnetic resonance imaging to clear the spine of injury

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2051. (1390) Q5-1761:

Which of the following properties is the same for both botulinum toxin types A and B:

1) Dose
3) Antigenicity
2) Duration of action
5) Molecular structure
4) Mechanism of action

There are seven serologic subtypes of botulinum toxin, and only two are approved for clinical use. The duration of action of type A is slightly longer and it is less antigenic. Both type A and B have different structures. The dose of type A is lower in absolute units. Both have the same site of action â they inhibit the release of acetylcholine from the neuromuscular junction, although they act on different proteins inside the cell.Correct Answer: Mechanism of action

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2052. (1548) Q5-1940:

Stickler syndrome is caused by a mutation in the gene for which of the following:

1) Collagen
3) Glycoprotein
2) Fibrillin
5) Fibroblast growth factor
4) Osteopontin

Stickler syndrome is characterized by premature osteoarthritis in multiple joints, visual complications, auditory defects, and cleft palate. Stickler syndrome is caused by a defect in the genes for type 2 or type 11 collagen.Correct Answer: Collagen

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2053. (1549) Q5-1941:

Stickler syndrome is characterized by all of the following features except:

1) Visual disorders
3) Degenerative joint disease
2) Hearing problems
5) Irregular vertebral endplates
4) Significant short stature

Stickler syndrome, also known as hereditary arthro-ophthalmopathy, is characterized by visual problems, progressive hearing loss, and malar or mandibular hypoplasia. In terms of orthopedic complications, most patients develop premature degenerative joint disease and disk abnormalities, including narrow and irregular endplates. Significant short stature is not common in patients with Stickler syndrome.Correct Answer: Significant short stature

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2054. (1550) Q5-1942:

The majority of pediatric pedestrian-vehicle injuries occur in which time period:

1) 12 AM to 5 AM
3) 10 AM to 3 PM
2) 5 AM to 10 AM
5) 8 PM to 12 PM
4) 3 PM to 8 PM

The majority (54%) of pediatric pedestrian-vehicle accidents occur from 3 pm to 8 pm. This time period may coincide with walks home from school, after-school play, and high traffic volume.Correct Answer: 3 PM to 8 PM

2055. (1551) Q5-1943:

Which of the following demographic factors places a child at increased risk of pedestrian vs vehicle trauma:

1) Female gender
3) 5 to 9 years old
2) Younger than 5 years old
5) 15 to 19 years old
4) 10 to 14 years old

Male gender and age 5 to 9 years old are factors that place children at increased risk of being struck by a vehicle.Correct Answer: 5 to 9 years old

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2056. (1552) Q5-1944:

Before any intervention, which of the following statements is true regarding the walking gait of a diplegic patient who has an equinus gait:

1) Ankle plantarflexion increases during single-limb stance.
3) Ankle plantarflexion does not change during single-limb stance.
2) Ankle plantarflexion decreases steadily during single-limb stance.
5) Knee flexion initially increases during stance-phase loading.
4) Ankle varus increases during stance.

In patients with spastic diplegia, ankle plantarflexion increases during single-limb stance, contrary to the normal pattern.Correct Answer: Ankle plantarflexion increases during single-limb stance.

2057. (1553) Q5-1945:

Which of the following complications is the most common in anterior iliac crest graft harvesting:

1) Hematoma
3) Sensory disturbance
2) Muscle herniation
5) Fracture
4) Pain

Transient or permanent sensory disturbance is the most common complication (13% of patients) of anterior iliac crest graft harvesting.Correct Answer: Sensory disturbance

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2058. (1554) Q5-1946:

Which of the following is the most common site for primary epiphyseal osteomyelitis:

1) Proximal femur
3) Proximal tibia
2) Distal femur
5) Proximal humerus
4) Distal tibia

Osteomyelitis of the epiphysis is less common than osteomyelitis of the metaphysis. Osteomyelitis of the epiphysis may occur from spread across transphyseal vessels or primary hematogenous seeding. The most common location is the distal femoral epiphysis, and it most commonly affects infants and young children.Correct Answer: Distal femur

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2059. (1555) Q5-1947:

A normal (negative) result is used to rule out septic arthritis of the hip on which of the following tests:

1) Plain radiographs
3) Culture of joint fluid
2) Ultrasound
5) None of the above
4) C-reactive protein

False-negative results may occur with each of the tests. Culture results may be negative in up to a quarter of patients. Ultrasound may be false-negative in up to 20% of patients with septic arthritis of the hip. C-reactive protein may be normal early in the course of disease. The diagnosis is based upon a constellation of findings, including clinical examination.Correct Answer: None of the above

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2060. (1556) Q5-1948:

Which of the following structures is the primary stabilizer of the atlantoaxial segment against anterior atlantal translation:

1) Apical ligament
3) Anterior atlantodental ligament
2) Alar ligament
5) Ligamentum nuchae
4) Transverse ligament

The transverse ligament is the primary stabilizer of the atlantoaxial segment against anterior atlantal translation. The transverse ligament runs between the lateral masses of C1 and behind the odontoid process. The apical ligament is attached to the tip of the odontoid and the occiput, but not C1. The paired alar ligaments run obliquely and are secondary restraints, as is the anterior atlantodental ligament. The ligamentum nuchae is a strong condensation of fibers extending from the external occipital protuberance to the tips of the spinous processes C2-C7.Correct Answer: Transverse ligament

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2061. (1557) Q5-1949:

The radiographic line delimiting the foramen magnum that is used in determining basilar invagination is the:

1) McGregor line
3) Chamberlain line
2) McRae line
5) Swischuk line
4) Ranawat line

The McRae line is from the anterior to the posterior lip of the foramen magnum. Protrusion of the odontoid above this line indicates basilar invagination. The McGregor and Ranawat lines are also used to evaluate basilar invagination. The Swischuk line is from the posterior cortex of C1 to C3 lamina and is used in evaluating pseudosubluxation.Correct Answer: McRae line

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2062. (2216) Q5-2643:

Which of the following factors determines the treatment for a child with tibial hemimelia:

1) The presence of a patella
3) The presence of a proximal tibial remnant
2) The length of the fibula
5) The status of the menisci
4) The status of the cruciate ligaments

When treating a child with tibial hemimelia, the surgeon must decide whether to attempt to reconstruct the knee or perform a disarticulation. The determining factor is whether there is a proximal tibial remnant.

Correct Answer: The presence of a proximal tibial remnant

2063. (2217) Q5-2644:

Which of the following is a contraindication to the use of vacuum assisted closure (VAC) (Kinetic Concepts Inc., San Antonio, Tex):

1) A deep surgical wound
3) A wound with necrotic muscle that has not been debrided
2) An acute soft tissue wound
5) A chronic wound that is slow to close
4) A fresh, split-thickness skin graft

Vacuum assisted closure (VAC) should be applied to infected or damaged tissue *after* debridement. All of the other possible answer choices are conditions for which VAC is appropriate.

Correct Answer: A wound with necrotic muscle that has not been debrided

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2064. (2218) Q5-2645:

The recommended interval for changing wound vacuum assisted closure (VAC) (Kinetic Concepts Inc., San Antonio, Tex) dressings is:

1) Twice daily
3) Every 2 days
2) Daily
5) Monthly
4) Weekly

The preferred interval for changing VAC dressings is every 2 days. Patients may have significant discomfort with initial dressing changes; however, the pain usually diminishes rapidly.Correct Answer: Every 2 days

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2065. (2219) Q5-2646:

In children with Ewingâs sarcoma, the risk of local recurrence at the tumor site after treatment is greatest in which region:

1) Midshaft femur
3) Pelvis
2) Proximal fibula
5) Proximal humerus
4) Distal femur

The risk of local recurrence is greatest for Ewingâs sarcomas arising in the pelvis. The prognosis is poor. Many centers attempt resection of the pelvis if there is a good response to chemotherapy.

Correct Answer: Pelvis

2066. (2220) Q5-2647:

What is the histological difference between avascular necrosis of the femoral head in children versus adults:

1) Children have less creeping substitution than adults.
3) Large areas of fibrovascular tissue do not form in children.
2) Children do not demonstrate osseous collapse.
5) Children do not have any residual changes after 2 years.
4) There is no osteoclastic resorption in children.

Avascular necrosis models of the femoral head in immature animals show more osteoclastic resorption, fibroblastic response, and little creeping substitution when compared to models of mature animals. Osseous collapse is common, and there are often long-term residual changes in the shape of the femoral head.Correct Answer: Children have less creeping substitution than adults.

2067. (2221) Q5-2648:

Which of the following is a principle of the Ponseti technique for correction of a clubfoot:

1) Avoid use of casts
3) Perform a comprehensive release
2) Avoid use of braces
5) Minimize surgery to bones and joints
4) Osteotomies produce correction

The Ponseti technique, which was developed and tested by Ignacio Ponseti, MD, involves slow, gradual correction of a clubfoot using casts, a tenotomy if necessary to release the Achilles tendon, and maintenance of correction using braces (foot abduction orthoses) for several years. The technique avoids dissection of the growing bones and joints of a childâs foot because of the associated risks of stiffness and growth disturbance.Correct Answer: Minimize surgery to bones and joints

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2068. (2222) Q5-2649:

Which of the following pulse sequences is best for showing anatomy on magnetic resonance imaging (MRI):

1) T1-weighted images
3) Proton density images
2) T2-weighted images
5) Gradient echo sequence
4) Fat-suppressed T2-weighted images

T1-weighted images generally display the best anatomical detail. Fat is bright, and muscle is dark, giving excellent contrast. Cortical bone, tendons, and ligaments are low signal.Correct Answer: T1-weighted images

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2069. (2223) Q5-2650:

Which of the following pulse sequences is best for imaging the pediatric growth plate:

1) T1-weighted images
3) Proton density images
2) T2-weighted images
5) Gradient echo sequence
4) Fat-suppressed T2-weighted images

The gradient echo sequence involves a short relaxation and excitation time. It shows both fat and water as intermediate signals. The gradient echo sequence is excellent for imaging physeal and articular cartilage. When imaging for a physeal bar, the physician ordering the magnetic resonance imaging should specify this sequence.Correct Answer: Gradient echo sequence

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2070. (2224) Q5-2651:

Motion artifact in magnetic resonance imaging of the pediatric spine is caused by all of the following except:

1) Patient movement
3) Cerebrospinal fluid flow
2) Cardiac activity
5) A flexible titanium rod in the femur
4) Respiration

Motion artifact affects magnetic resonance imaging of the spine and can result from patient movement (common in children under 8 years old), cardiac activity, respiration, and cerebrospinal fluid flow. Presence of a titanium rod in a childâs femur, while causing a local signal void, does not affect spinal imaging.Correct Answer: A flexible titanium rod in the femur

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2071. (2225) Q5-2652:

There are no internal moments in the lower extremity during which phase of gait:

1) Initial contact
3) Terminal stance
2) Midstance
5) Initial swing
4) Preswing

Preswing is the only phase of gait in which all muscle groups are silent in the ipsilateral lower extremity. In the next phase (initial swing), internal moments are generated at the hip and ankle to initiate swing.Correct Answer: Preswing

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2072. (2226) Q5-2654:

The protein neurofibromin normally acts in which of the following ways:

1) Inhibits fibroblast growth factor
3) Downregulates Ras protein
2) Promotes proteoglycan assembly
5) Promotes tumor formation
4) Causes nerve cells to divide

If defective, neurofibromin is the protein that causes neurofibromatosis. Neurofibroma is coded on chromosome 17, and it acts as a tumor suppressor by downregulating Ras protein, which enhances cell growth and proliferation.Correct Answer: Downregulates Ras protein

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2073. (2227) Q5-2655:

According to National Institutes of Health (NIH) criteria, what is the minimum number of 15-mm cafÃ©-au-lait macules required as a diagnostic criterion for neurofibromatosis in postpubertal patients:

1) One
3) Three
2) Two
5) Six
4) Four

The NIH criteria require at least six 15-mm cafÃ©-au-lait macules in postpubertal patients. CafÃ©-au-lait macules must be larger than 5 mm in prepubertal patients.Correct Answer: Six

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2074. (2228) Q5-2656:

A 7-year-old girl presents with an acute fracture of her proximal radial metaphysis. Although a line down the shaft of the radius intersects the center of the capitellum, the articular surface of the radial head is angled 20Â° from the anatomic position as compared with the other elbow. You recommend:

1) Observation with follow-up in 1 week
3) Closed manipulation with a supination maneuver
2) Closed manipulation with a pronation maneuver
5) Open reduction and internal fixation
4) Closed manipulation with a percutaneous K-wire

Proximal radial fractures have excellent remodeling potential, especially if the angulation is less than 30Â°. Manipulation is not necessary, and the risk of stiffness from any invasive procedure is not worthwhile.Correct Answer: Observation with follow-up in 1 week

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2075. (2229) Q5-2657:

Which of the following findings is typical in patients with Marfan syndrome as opposed to patients with Ehlers-Danlos syndrome:

1) Scoliosis
3) Pes planus
2) Dural ectasia
5) Joint pains
4) Lens dislocation

All of the findings presented, with the exception of lens dislocation, are seen in both syndromes at a frequency that exceeds the general population. Lens dislocation is common in patients with Marfan syndrome but not those with Ehlers-Danlos syndrome.Correct Answer: Lens dislocation

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2076. (2230) Q5-2658:

Ehlers-Danlos syndrome is caused by a defect in which of the following:

1) Elastin
3) Dermatan sulfate
2) Collagen
5) Fibroblast growth factor
4) Proteoglycan

There are 11 subtypes of Ehlers-Danlos syndrome. Each of the subtypes is caused by defects in collagen types 1, 3, or 5, or their processing. Defects in a component of elastic microfibrils (fibrillin) are responsible for Marfan syndrome. Defects in dermatan sulfate processing cause Hurler syndrome. Defects in fibroblast growth factor cause achondroplasia. Defects in proteoglycan processing cause diastrophic dysplasia.

Correct Answer: Collagen

2077. (2231) Q5-2659:

A 4-year-old boy with macrodactyly of the foot has involvement of the second and third rays. He undergoes debulking of the soft tissues of the phalanges and amputation of the distal phalanges. Two years later, he returns with a dramatic increase in the width and length of the involved regions. You recommend:

1) Epiphyseodesis of the phalanges and metatarsals
3) Ray resection of one of the involved rays with further debulking
2) Amputation of the proximal phalanges
5) Syme amputation
4) Chopart amputation

The increase in width of the involved regions can be handled only by ray resection. Additional proximal levels of amputation are not required.Correct Answer: Ray resection of one of the involved rays with further debulking

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2078. (2232) Q5-2660:

A 14-year-old girl is kicking a soccer ball when she feels a âpopâ in her hip. The most likely diagnosis is:

1) Slipped sacroiliac joint
3) Pathologic hip fracture
2) Slipped capital femoral epiphysis
5) Ligamentum teres avulsion
4) Avulsion of the anterior inferior iliac spine

This is a classic description of avulsion of the anterior inferior iliac spine. When this patient hyperextended her hip and flexed her knee simultaneously to kick a ball, the rectus femoris was stretched at both joints. In a skeletally immature patient, this apophysis is not fully ossified and is vulnerable to avulsion. Treatment is symptomatic, with return to sports in about 6 weeks.Correct Answer: Avulsion of the anterior inferior iliac spine

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2079. (2233) Q5-2661:

A 3-year-old boy has a progressive anterior bow of the right tibia. He experiences intermittent aching. His physical examination is otherwise unremarkable. Radiographs reveal 25Â° of anterior bow of the tibia just distal to the midshaft and 20Â° of lateral bow. There is some narrowing of the medullary canal around the bow and thinning of the anterior cortex. You recommend which course of action:

1) Floor reaction ankle-foot orthosis
3) Osteotomy and plate fixation
2) Osteotomy and intramedullary rod
5) Free vascularized fibular graft
4) Tibiofibular synostosis

This patient has a congenitally dysplastic tibia. The tibia is at risk for fracture, but orthotic protection is sometimes successful in preventing fracture. Operative intervention should be reserved for fracture because there is a significant risk of nonunion or delayed union.Correct Answer: Floor reaction ankle-foot orthosis

2080. (2234) Q5-2662:

An 8-year-old patient with cerebral palsy has an equinovarus foot on the right side. The varus is worse during push-off. He also holds his right upper extremity stiffly when he walks. He is developing a pressure callus on the lateral side of his foot in the region of the calcaneocuboid joint. Passively, the foot can be corrected to a neutral position of varus-valgus but lacks 12Â° from neutral dorsiflexion. Your recommendation is:

1) Ankle-foot orthosis (AFO)
3) Lengthening of the triceps surae and triple arthrodesis
2) Lengthening of the triceps surae
5) Lengthening of the triceps surae and split posterior tibial tendon transfer
4) Tendoachilles lengthening and peroneal shortening

An equinovarus foot is commonly found in patients with hemiplegic cerebral palsy. The varus aspect is difficult to brace. In this patient with fixed equinus, an AFO would not be a successful treatment option. A lengthening of the triceps surae would be indicated, and it could be done at the level of the Achilles tendon or by a gastrocnemius-soleus recession, depending on the clinical examination. In addition, another procedure is necessary to deal with the varus. The best way to accomplish this would be by split posterior tibial tendon transfer. This patient is too young for a triple arthrodesis, as this procedure is appropriate in patients at or near skeletal maturity with rigid deformity.

Correct Answer: Lengthening of the triceps surae and split posterior tibial tendon transfer

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2081. (2235) Q5-2663:

Hip subluxation is most commonly seen in which type of cerebral palsy:

1) Spastic hemiplegia
3) Spastic triplegia
2) Spastic diplegia
5) Athetoid
4) Total involvement

Neuromuscular subluxation of the hips is caused by muscle imbalance over time. It is most common in patients with greatest imbalance â total body involvement. Hip subluxation is rare in patients with spastic hemiplegia.

Correct Answer: Total involvement

2082. (2236) Q5-2664:

Which group of cerebral palsy patients is most likely to sustain a pathologic fracture:

1) Spastic hemiplegic
3) Spastic triplegic
2) Spastic diplegic
5) Athetoid
4) Total involvement

Pathologic fracture is most common in cerebral palsy patients with total involvement, presumably because they have little stress on the bone from either muscle tone or standing.

Correct Answer: Total involvement

2083. (2237) Q5-2665:

Which is the most common location of pathologic fracture in patients with cerebral palsy:

1) Radius
3) Humerus
2) Femur
5) Calcaneus
4) Tibia

Pathologic fracture is a common problem in patients with cerebral palsy. Pathologic fracture most commonly involves the femur, especially the shaft and distal metaphysis. This should be the first diagnostic consideration in a nonambulatory patient with a warm or swollen knee.Correct Answer: Femur

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2084. (2238) Q5-2666:

A 5-year-old girl is brought to the emergency department because of fever and inability to walk. Her temperature is 100.5Â° F. She has pain with rotation of the hip. However, if the movement is done slowly, the hip can be rotated internally and externally 45Â°. Her white blood cell count is 13,000 (upper normal is 12,500 for her age). Her erythrocyte sedimentation rate is 30. Radiographs of the pelvis and hip are normal. You recommend:

1) Bed rest with follow-up contact the next day
3) Hip aspiration
2) Ultrasound of the hip
5) Irrigation and drainage of the hip
4) Magnetic resonance imaging

The scenario described above is most consistent with transient synovitis of the hip. Because range of motion is tolerated when performed slowly; it is compatible with a diagnosis of transient synovitis of the hip more than infection. Rest, with or without anti-inflammatory medicine, should produce a dramatic improvement by the next day.

Correct Answer: Bed rest with follow-up contact the next day

2085. (2239) Q5-2667:

Which of the following factors is least likely to predispose a patient to patellar instability:

1) Genu varum
3) Patella alta
2) Excessive femoral anteversion
5) Hypoplastic lateral femoral trochlear ridge
4) External tibial torsion

Genu varum does not predispose a patient to patellar instability. However, genu valgum, as well as all of the other factors listed above, may predispose a patient to this condition.

Correct Answer: Genu varum

2086. (2240) Q5-2668:

A 15-year-old girl twists her knee while skiing. She is diagnosed with a patellar dislocation. She has had no prior episodes. Radiographs show the dislocation but no other findings. After reducing the dislocation, you recommend:

1) Knee immobilization for 2 to 3 weeks
3) Repair of the medial patellofemoral ligament
2) Long-leg cast for 6 weeks
5) Proximal realignment
4) Tibial tubercle transfer

Acute traumatic patellofemoral dislocations are best treated by brief immobilization followed by early rehabilitation. Surgery is reserved for patients with multiple recurrences that cause significant disability.

Correct Answer: Knee immobilization for 2 to 3 weeks

2087. (2241) Q5-2669:

Which of the following is related to the etiology of Ewingâs sarcoma:

1) Chromosomal translocation (11/22)
3) Bacterial infection
2) Viral infection
5) Single base mutation
4) Trauma

Ewingâs sarcoma belongs to the family of round cell sarcomas. A translocation t(11:22)(q24q12) has been discovered in Ewingâs sarcoma. This translocation results in a novel protein, EWS-FL11, that causes rapid growth of cells arising from the neural crest.

Correct Answer: Chromosomal translocation (11/22)

2088. (2242) Q5-2670:

A 5-year-old girl is brought to your office because of a mass in the back of her right knee. The family has noticed the mass for the past 8 months, and they also tell you that it varies in size with activity. The mass is painless and is located on the medial side of the popliteal fossa. It measures 2 cm to 4 cm and is discrete, firm, and nontender. Examinations of her knee and gait are unremarkable otherwise. You recommend:

1) Observation with return if any changes
3) Aspiration
2) Magnetic resonance imaging
5) Knee arthroscopy to look for intra-articular causes
4) Excisional biopsy

The patient history and physical examination are consistent with a benign popliteal cyst. This type of cyst is usually unassociated with any intra-articular pathology in children. The cyst resolves on its own with time. Further study or biopsy would be indicated only if the mass were progressively enlarging, tender, or located in an atypical area.

Correct Answer: Observation with return if any changes

2089. (2243) Q5-2671:

A 20-month-old toddler is brought in because of bowed legs. You note moderate-to-severe genu varum and thigh-foot angles of 35Â° inward. The child is otherwise healthy, and height and weight are near the 50th percentiles. Radiographs demonstrate tibial metaphyseal-diaphyseal angles of 8Â° on the right and 9Â° on the left. Femoral metaphyseal-diaphyseal angles are the same. You recommend:

1) Observation, with return only if not improving
3) Serial casting until straight
2) Measurement of electrolytes, alkaline phosphatase, and vitamin D levels
5) Osteotomies of the proximal tibias
4) Bracing in knee-ankle-foot orthoses

This child has physiologic genu varum. Only if the metaphyseal-diaphyseal angles were greater than 11Â° would additional follow-up be indicated, with possible bracing. Blood tests would be indicated if the bone quality showed evidence of Rickets or if the child was below the 10th percentile in height.

Correct Answer: Observation, with return only if not improving

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2090. (2244) Q5-2672:

Which of the following is the most common complication after a posttraumatic distal radial growth arrest:

1) Positive distal ulnar variance
3) Increased distal radial articular angle
2) Negative distal ulnar variance
5) Distal radioulnar joint instability
4) Decreased distal radial articular angle

The most common complication after a posttraumatic distal radial growth arrest is positive ulnar variance (overgrowth). Other complications may include decreased distal radial articular angle, triradiate fibrocartilage tear, or distal radioulnar joint instability, but they are less common. Increased radial articular angle and negative ulnar variance rarely develop after these injuries.

Correct Answer: Positive distal ulnar variance

2091. (2245) Q5-2673:

Patients with which one of the following curve types associated with idiopathic scoliosis are at increased risk of shortness of breath:

1) Thoracic curves larger than 80Â°
3) Thoracolumbar curves larger than 100Â°
2) Thoracolumbar curves larger than 80Â°
5) Lumbar curves larger than 100Â°
4) Lumbar curves larger than 80Â°

Idiopathic scoliosis is associated with measurable decreases in pulmonary function in thoracic curves larger than 60Â° to 70Â°, but a clinically significant increase in risk of shortness of breath has been shown only in thoracic curves larger then 80Â°.

Correct Answer: Thoracic curves larger than 80Â°

2092. (2246) Q5-2674:

Which of the following patients with infantile idiopathic scoliosis can be observed without a magnetic resonance image (MRI):

1) A patient with a curve less than 20Â°
3) A patient with a right thoracic curve
2) A patient with a normal neurologic examination
5) A patient without any pain
4) A patient younger than 2 years old

Patients with idiopathic infantile scoliosis have a 22% incidence of abnormalities that can be viewed on MRI. Syrinx and Chiari malformation are the most common abnormalities, with a similar rate as that found in patients with juvenile idiopathic scoliosis. The left thoracic curve pattern is most commonly seen in infantile patients, but a right thoracic curve is not protective. Age, freedom from pain, or a normal neurologic examination are also not protective. Magnetic resonance imaging is recommended for all infantile curves larger than 20Â°.

Correct Answer: A patient with a curve less than 20Â°

2093. (2247) Q5-2675:

Which of the following features differentiates a grade 2 open fracture from a grade 1 open fracture:

1) Laceration larger than 1 mm
3) Laceration larger than 1 in
2) Laceration larger than 1 cm
5) Associated vascular injury
4) Associated neurologic injury

A grade 2 open fracture is distinguished from a grade 1 open fracture by a laceration larger than 1 cm. Grade 3 open fractures are characterized by massive soft tissue damage, circulatory compromise, severe contamination, or marked instability. Grade 3A open fracture characteristics include extensive soft tissue lacerations but adequate skin to cover the bone. Grade 3B fractures show extensive soft tissue loss. Grade 3C open fractures demonstrate arterial injury and require repair.

Correct Answer: Laceration larger than 1 cm

2094. (2248) Q5-2676:

Which of the following features differentiates a grade 3B open fracture from a grade 3C open fracture:

1) Presence of neurologic injury
3) Presence of vascular injury not requiring repair
2) Presence of vascular injury requiring repair
5) Massive contamination
4) Segmental bone loss

Grade 3 injuries all have massive soft tissue damage. Grade 3C fractures have vascular injury requiring repair, whereas grade 3B fractures do not have vascular injury or do not require repair. An example of the latter is a severe open fracture of the distal tibia with laceration of the dorsalis pedis artery and a foot that is well perfused through its collaterals.

Correct Answer: Presence of vascular injury not requiring repair

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2095. (2249) Q5-2677:

Which rating best describes a childâs hip affected with Perthesâ disease that has healed with aspherical incongruity:

1) Catterall 3
3) Herring C
2) Catterall 4
5) Stulberg 5
4) Stulberg 4

The Catterall and Herring classifications are used during the evolution of Perthesâ disease to guide treatment; they are used during the fragmentation stage. It is impossible to know what the Catterall or Herring class was after healing has occurred. The Stulberg classification gives prognosis after healing. Stulberg 4 is aspherical but congruous. Stulberg 5 is aspherical and incongruous. Patients classified with Stulberg 5 hips typically have degenerative joint disease in early adulthood.

Correct Answer: Stulberg 5

2096. (2250) Q5-2678:

Which of the following agents is used to reverse the effects of midazolam:

1) Naloxone
3) Flumazenil
2) Naltrexone
5) Atropine
4) Fentanyl

Flumazenil (reversed) is used to reverse the effects of benzodiazepines. Flumazenil has a shorter duration of action than benzodiazepines, so it may need to be readministered. Flumazenil can also precipitate seizures.Correct Answer: Flumazenil

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2097. (2251) Q5-2679:

A 6-year-old boy is receiving pharmacologic agents to assist in the reduction of a forearm fracture. Which of the following conditions is not necessary for him to be in âconscious sedationâ:

1) His consciousness is fully normal.
3) His airway reflexes are maintained.
2) He can open his eyes to command.
5) His vital signs are stable.
4) He maintains a patent airway.

Under conscious sedation, a child must be able to open eyes to command, maintain a patent airway and reflexes, and have stable vital signs. However, consciousness is medically depressed by the drugs.

Correct Answer: His consciousness is fully normal.

2098. (2252) Q5-2680:

A mutation in type II collagen is responsible for all of the following conditions except:

1) Stickler syndrome
3) Kniest syndrome
2) Spondyloepiphyseal dysplasia congenita
5) Achondroplasia
4) Strudwick dysplasia

Type II collagen is largely found in hyaline cartilage. All of the dysplasias, with the exception of achondroplasia, have significant abnormalities of articular cartilage. Achondroplasia results from a defect in fibroblast growth factor receptor protein.

Correct Answer: Achondroplasia

2099. (2253) Q5-2681:

An adult man with hemophilia A has just announced the birth of his first son. His wife does not have the disease. What is the chance that the newborn has the disorder:

1) 100%
3) 25%
2) 50%
5) Less than 1%
4) 10%

Hemophilia A is an X-linked disorder. Therefore, there is no father-son transmission. The chance that the newborn is affected equals that of the general population, which is less than 1%.

Correct Answer: Less than 1%

2100. (2254) Q5-2682:

Which of the following conditions is least commonly seen in patients with congenital dislocation of the patella:

1) Fibrosis of the vastus lateralis
3) Hypoplasia of the vastus medialis
2) Contracture of the iliotibial band
5) Flexion contracture
4) Enlarged patella

Congenital dislocation of the patella is present from birth and diagnosed in childhood. It is not reducible with the knee in extension. Essential elements include contracture of the iliotibial band, vastus lateralis, hypoplasia of the vastus medialis, lateral insertion of the patellar tendon, decreased size of the patella, flexion contracture and valgus alignment of the knee, and hypoplasia of the patellar sulcus. Operative treatment is usually successful, and the success rate is increased with early surgery.

Correct Answer: Enlarged patella

2101. (2255) Q5-2683:

The surgical reconstruction of a congenitally dislocated patella includes all of the following elements except:

1) Advancement of the vastus medialis insertion
3) Lengthening or release of the biceps femoris muscle
2) Lengthening or release of the iliotibial band
5) Lateral transfer of the patellar tendon insertion
4) Lateral capsular release

The surgical reconstruction of a congenitally dislocated patella includes lengthening or release of the lateral capsule, lengthening or release of the iliotibial band, lengthening or release of the biceps femoris muscle, distal advancement or imbrication of the patellar tendon, and sometimes a rectus femoris lengthening. Semitendinosus transfer to the patella may also be added. The lateral insertion of the patellar tendon may be transferred medially.

Correct Answer: Lateral transfer of the patellar tendon insertion

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2102. (2256) Q5-2684:

Which of the following radiographic parameters is most appropriately used to assess the status of the hip in a growing child with cerebral palsy:

1) The Stulberg rating
3) The alpha and beta angle of Graf
2) The migration index of Reimer
5) The Hilgenreiner-epiphyseal angle
4) Kleinâs line

The migration index (of Reimer) is the percentage of the femoral head outside of the acetabulum. This radiographic parameter tracks the progress of the hip in patients with cerebral palsy because the femoral head may gradually migrate out.

The other parameters refer to radiographic assessments of other hip disorders:

- The Stulberg rating is used in patients with healed Perthesâ disorder.
- The alpha and beta angles of Graf provide ultrasonic assessment of patients with developmental hip dysplasia.
- Kleinâs line is used in early detection of slipped capital femoral epiphysis.
- The Hilgenreiner-epiphyseal angle is used in developmental coxa vara.

Correct Answer: The migration index of Reimer

2103. (2257) Q5-2685:

What is the primary force applied to the spine during a Chance (seatbelt) fracture:

1) Flexion
3) Rotation
2) Compression
5) Flexion and rotation
4) Distraction

The primary force applied to the spine during a Chance fracture is distraction. The body is flexed forward around an axis in front of the body (often a seatbelt), but the spine is subject to distraction because it is posterior to this axis. This motion results in a characteristic distraction of bony or ligamentous elements with minimal crush.

Correct Answer: Distraction

2104. (2258) Q5-2686:

Which of the following physical findings is uncommon in a patient with a unilateral untreated clubfoot:

1) Thin calf
3) Plantar-medial prominence of the talus in the foot
2) Loss of prominence of the heel
5) Decreased length of the foot
4) Medial midfoot crease

In a patient with unilateral untreated clubfoot, certain findings are apparent when compared with the unaffected foot. Common findings include a thinner calf, shorter-appearing foot, loss of heel prominence, and a medial midfoot crease. The talus is prominent anterolaterally in the foot but not on the plantar-medial side.

Correct Answer: Plantar-medial prominence of the talus in the foot

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2105. (2259) Q5-2687:

Which of the following radiographic findings is present in a varus foot:

1) Increased parallelism of the talus and calcaneus on lateral film
3) Increased divergence of the talus and calcaneus on the anteroposterior film
2) Superimposition of the anterior portions of the talus and calcaneus on the lateral film
5) Increased superimposition of the metatarsal heads on lateral film
4) Increased abduction of the forefoot on the hindfoot

Plain radiographs of a foot that is in varus show increased parallelism of the talus and the calcaneus on both the anteroposterior and lateral films. There is decreased superimposition of the talus, the calcaneus, and the metatarsal heads. By contrast, in a valgus foot, there is increased divergence on both the anteroposterior and lateral films.

Correct Answer: Increased parallelism of the talus and calcaneus on lateral film

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2106. (2260) Q5-2688:

Although all of the following conditions may present in patients with skeletal dysplasia, which is the only condition that does not have a high frequency of spontaneous improvement:

1) Infantile foramen magnum stenosis in patients with achondroplasia
3) Cervical kyphosis in patients with diastrophic dysplasia
2) Infantile thoracolumbar kyphosis in patients with achondroplasia
5) Hypotonia in patients with achondroplasia
4) Cervical kyphosis in patients with Larsen syndrome

Cervical kyphosis does not improve in patients with Larsen syndrome and may cause myelopathy. Early arthrodesis (posterior only, if not too severe) is indicated. All of the other conditions have a high incidence of spontaneous improvement, so they are most appropriately treated with observation. In a minority of cases, the deformity does not improve and surgery is indicated.

Correct Answer: Cervical kyphosis in patients with Larsen syndrome

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2107. (2261) Q5-2689:

All of the following conditions may affect lower extremities in children. Which one of the conditions does not have a high incidence of spontaneous improvement:

1) Posteromedial bow of the tibia
3) Metatarsus adductus
2) Calcaneovalgus foot
5) Anterolateral bowing of the tibia
4) Internal tibial torsion

Anterolateral bowing of the tibia is usually associated with tibial dysplasia and may progress to pseudarthrosis. Anterolateral bowing of the tibia does not resolve in most patients. Posteromedial bowing of the tibia usually resolves, although there may be a residual shortening of the tibia. All of the other conditions often completely resolve.

Correct Answer: Anterolateral bowing of the tibia

2108. (2262) Q5-2690:

The anterior interosseous nerve enables:

1) Sensation and flexion of the thumb and index fingers
3) Flexion of the lateral (ulnar) two fingers
2) Flexion of the thumb and index fingers
5) Abduction of the thumb
4) Flexion and sensation of the ulnar two fingers

The anterior interosseous nerve does not carry any sensory fibers. The anterior interosseous nerve enables flexion of the thumb (flexor digitorum pollicis) and index fingers (flexor digitorum profundus). This is the most commonly injured nerve in a supracondylar fracture, and it nearly always spontaneously recovers.

Correct Answer: Flexion of the thumb and index fingers

2109. (2263) Q5-2691:

Closed reduction without internal fixation is most likely to produce a satisfactory result in which of the following types of supracondylar fracture:

1) An intact posterior hinge and 20Â° of hyperextension
3) Posterior and medial translation with no intact hinge
2) An intact lateral hinge and 15Â° of varus
5) Anterior translation with 10Â° of varus
4) Posterior and lateral translation with no intact hinge

There are many options when treating a supracondylar fracture, but a surgeon should always choose the method with the highest percentage of good results for a given fracture. Answer A describes a type II supracondylar fracture with hyperextension and no varus-valgus displacement. The posterior hinge is intact, and it is relatively simple to reduce the fracture with flexion, immobilizing it at 120Â°. For the other fractures listed as possible answer choices, the reduction as well as the assessment of reduction is more complex. Therefore, most experts would prefer percutaneous fixation of these fractures once reduced.

Correct Answer: An intact posterior hinge and 20Â° of hyperextension

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2110. (2264) Q5-2692:

The highest rate of success in restoring growth after physeal bar resection is found in which location:

1) Proximal femur
3) Proximal tibia
2) Distal femur
5) Proximal humerus
4) Distal tibia

The highest rate of success after physeal bar resection is found in the distal tibia. The mean growth after resection in the series by Peterson was 93% of that expected, which is greater than the success rates of the other locations. The reasons for this remain speculative but may be due to the more peripheral location of the bar at the ankle, less complex physeal shape, and lower energy of injury. Physeal bars in the proximal femur and humerus are rarely surgically treated.

Correct Answer: Distal tibia

2111. (2265) Q5-2693:

Which of the following fracture types are most prone to nonunion or refracture in patients with osteogenesis imperfecta:

1) Supracondylar humeral fractures
3) Supracondylar femur fractures
2) Olecranon apophysis fractures
5) Calcaneal fractures
4) Tibial fractures

Unless they are internally fixed, olecranon fractures are notoriously prone to nonunion or refracture in patients with osteogenesis imperfecta. The remaining fractures can be treated nonoperatively with cast immobilization.

Correct Answer: Olecranon apophysis fractures

2112. (2266) Q5-2694:

An 11-year-old boy has multiple, hard, tender nodules in his posterior shoulder girdle and paraspinous muscles. He also has a shortened first metatarsal with a delta-shaped first proximal phalanx. The diagnosis is:

1) Dysplasia epiphysialis hemimelica
3) Fibrodysplasia ossificans progressiva
2) Multiple exostoses
5) Metastatic osteosarcoma
4) Myositis ossificans

Fibrodysplasia ossificans progressiva is a disorder of the BMP4 signaling pathway. This condition is characterized by multiple osseous masses occurring in muscle, especially in the dorsal and axial regions. There is also a characteristic dysmorphology of the great toe, consisting of a shortened first metatarsal, delta-shaped phalanx, and some valgus.

Correct Answer: Fibrodysplasia ossificans progressiva

2113. (2267) Q5-2695:

Klippel-Trenaunay syndrome is characterized by cutaneous capillary venous malformation, varicose veins, and which of the following:

1) Multiple enchondromas
3) Limb hypertrophy
2) Multiple osteochondromas
5) Congenital pseudarthrosis of the tibia
4) Seizure disorder

Klippel-Trenaunay syndrome has three essential features: cutaneous capillary venous malformation, varicose veins, and hypertrophy of the involved limb in length and/or width. The syndrome usually presents before adolescence. The tissue abnormalities typically do not cross the midline, and the entire limb is not uniformly affected.

Correct Answer: Limb hypertrophy

2114. (2268) Q5-2696:

Which of the following characterizes Russell-Silver syndrome:

1) Hemihypertrophy
3) Acromegaly
2) Hemiatrophy
5) Precocious puberty
4) Macrodactyly

Russell-Silver syndrome is characterized by a small triangular face, hemiatrophy of up to 5 cm, delay in skeletal age, and sometimes a developmental delay. Scoliosis is commonly found in patients with Russell-Silver syndrome.

Correct Answer: Hemiatrophy

2115. (2269) Q5-2697:

Macrodactyly is associated with all of the following syndromes except:

1) Neurofibromatosis
3) Klippel-Trenaunay syndrome
2) Proteus syndrome
5) Multiple enchondromatosis
4) Marfan syndrome

Macrodactyly is an increase in length and width of a digit or two adjacent digits. It may be associated with all of the above syndromes except for Marfan syndrome. Macrodactyly is also a common isolated condition.

Correct Answer: Marfan syndrome

2116. (2270) Q5-2698:

Which of the following conditions is inherited in an X-linked dominant fashion:

1) Hemophilia A
3) Marfan syndrome
2) Familial hypophosphatemic rickets
5) Sickle cell anemia
4) Prader-Willi syndrome

Familial hypophosphatemic rickets is inherited in an X-linked dominant fashion, meaning that there is an excess of affected females. Hemophilia A is sex-linked recessive like most X-linked conditions (seen primarily in males). Marfan syndrome is autosomal dominant, sickle cell anemia is autosomal recessive, and Prader-Willi syndrome is a partial deletion of chromosome 15.

Correct Answer: Familial hypophosphatemic rickets

2117. (2271) Q5-2699:

Which of the following statements is true regarding congenital pseudarthrosis of the tibia:

1) Congenital pseudarthrosis of the tibia is nearly always associated with neurofibromatosis.
3) Congenital pseudarthrosis of the tibia usually presents with a valgus deformity.
2) Congenital pseudarthrosis of the tibia usually occurs in the proximal one-third of the tibia.
5) The surrounding bone is usually dysplastic.
4) Congenital pseudarthrosis of the tibia usually presents with an apex-posterior bow.

Congenital pseudarthrosis of the tibia is associated with neurofibromatosis in approximately one-half of patients. It usually occurs in the distal portion of the tibia, presents with a varus position, and an apex-anterior bow. The surrounding bone is usually dysplastic, displaying segments of sclerosis, tapering, and/or cystic changes. The fibula is often dysplastic as well.

Correct Answer: The surrounding bone is usually dysplastic.

2118. (2272) Q5-2700:

Which of the following elements is most critical to the success of the Williams rod procedure (intramedullary rod fixation) for congenital pseudarthrosis of the tibia:

1) Fibular fixation
3) Prolonged orthotic protection
2) Leaving the rod across the ankle at the time of surgery
5) Ultrasound stimulation
4) Electrical stimulation

Fixation of the fibula allows shortening and compression of the tibia, as well as providing mechanical stability. Neither leaving the rod across the ankle nor prolonged orthotic protection beyond the initial postoperative period appears to be essential. Electrical stimulation does not have a quantifiable effect on the success of the procedure. Ultrasound has not been studied in this condition.

Correct Answer: Fibular fixation

2119. (2273) Q5-2701:

Which of the following is considered the cutoff for normal loss of C1-C2 articular contact in dynamic computed tomography (CT) in normal patients:

1) 10%
3) 40%
2) 20%
5) 80%
4) 50%

Up to 80% loss of contact between the C1 and C2 facet joints may be seen in normal patients. Therefore, dynamic CT is an oversensitive test and the dynamic feature does not add to CT in diagnosis.

Correct Answer: 80%

2120. (2274) Q5-2702:

In the absence of surgery, which of the following gait parameters in children with cerebral palsy tends to remain static with increasing age:

1) Knee range of motion
3) Normalized walking velocity
2) Ankle range of motion
5) Knee stiffness
4) Femoral anteversion

Most parameters of gait deteriorate over time in the absence of intervention in children with cerebral palsy. Knee and ankle range of motion decrease, as does walking velocity when normalized for height. Femoral anteversion remains unchanged. Knee stiffness increases.

Correct Answer: Femoral anteversion

2121. (2275) Q5-2703:

In patients with cerebral palsy, which of the following factors usually leads to an improvement in walking ability:

1) Increased body mass index
3) Increased age
2) Increased external tibial torsion
5) Alignment of the foot rocker with the line of progression
4) Valgus of the ankle

Gait in patients with cerebral palsy declines with increases in age, body mass index, external tibial torsion, and significant ankle valgus (due to worsened mechanics of pushoff). Gait is improved by aligning the foot rocker with the line of progression.

Correct Answer: Alignment of the foot rocker with the line of progression

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2122. (2276) Q5-2704:

Nonselective nonsteroidal anti-inflammatory drugs (NSAIDs) have the following effect on spinal fusion:

1) Increased speed of fusion
3) Decreased bleeding
2) Increased volume of fusion bone
5) Unplanned extension of fusion
4) Decreased fusion rate

Nonselective NSAIDs have been shown to decrease fusion rates in both animal models and in humans. The mechanism is most likely through an inhibition of cyclooxygenase (COX)-1 because COX-2 inhibitors do not show this effect.

Correct Answer: Decreased fusion rate

2123. (4051) Q5-2705:

The upper-end vertebra for measurement of kyphosis should always be:

1) T1
3) T3
2) T2
5) The most inclined upper vertebra on the sagittal plane.
4) T4

As in measurement of any spinal curve, the upper-end reference is the most inclined upper vertebra. One should carefully select this level and ensure that comparison measurements utilize the same vertebral levels.

Correct Answer: The most inclined upper vertebra on the sagittal plane.

2124. (2277) Q5-2706:

Which of the following aspects of reconstruction of chronic posttraumatic dislocation of the radial head has not been shown to improve the success rate:

1) Apex-posterior angulation
3) Slight lengthening
2) Rigid fixation
5) Radiocapitellar pin fixation
4) Early range of motion

Reconstruction with an ulnar osteotomy with apex-posterior angulation and slight lengthening with rigid fixation to allow early range of motion have been shown to improve results. Radiocapitellar pin fixation may cause arthrosis, breakage, and infection so it is not routinely recommended.

Correct Answer: Radiocapitellar pin fixation

2125. (2278) Q5-2707:

In patients with idiopathic adolescent scoliosis, clinically noticeable shortness of breath from restrictive lung disease begins to occur at a mean curve of:

1) 45Â° thoracic
3) 55Â° thoracic
2) 45Â° lumbar
5) 95Â° thoracic
4) 75Â° thoracic

Clinically noticeable pulmonary compromise begins to occur at a mean curve of 75Â° thoracic, although a decrease can be measured by pulmonary function testing with curves as little as 50Â°. Cor pulmonale does not occur until a curve is larger then 100Â°.

Correct Answer: 75Â° thoracic

2126. (2279) Q5-2708:

Which of the following statements is true of patients with idiopathic scoliosis not treated surgically (long-term follow-up data) when compared to nonscoliotic controls:

1) Patients had an increased mortality rate.
3) Patients had an increased prevalence of back pain.
2) Patients had an increased rate of neuropathy.
5) Patients had an increased rate of spinal fractures.
4) Patientsâ curves did not worsen after adulthood.

Patients with idiopathic scoliosis have a mortality rate that is not statistically different from the general population. They do not have a significant risk of neuropathy or spine fracture. Their curves worsen in maturity if they are greater than approximately 40Â°. They also have an increased prevalence of back pain.

Correct Answer: Patients had an increased prevalence of back pain.

2127. (2280) Q5-2709:

The cause of Ehlers-Danlos syndrome types I (gravis) and II (mitis) is a mutation in which of the following:

1) Fibrillin
3) Collagen type I
2) Fibroblast growth factor
5) Collagen type V
4) Collagen type II

Ehlers-Danlos syndrome is subclassified into at least nine types. Types I and II result from defects in type V collagen.

Correct Answer: Collagen type V

2128. (4052) Q5-2710:

The most common neural injury after a supracondylar fracture of the distal humerus is:

1) Anterior interosseous nerve
3) Posterior interosseous nerve
2) Median nerve
5) Ulnar nerve
4) Radial nerve

The most commonly injured nerve after a supracondylar fracture of the distal humerus is the anterior interosseous nerve. An injury to this nerve results in the inability to flex the interphalangeal joint of the thumb and the distal interphalangeal joint of the index finger.

Correct Answer: Anterior interosseous nerve

2129. (2281) Q5-2711:

Which of the following conditions does not have a risk of cervical deformity greater than the general population:

1) Neurofibromatosis
3) Diastrophic dysplasia
2) Larsen syndrome
5) Down syndrome
4) Achondroplasia

Achondroplasia is associated with frequent stenosis of the foramen magnum in infancy, as well as lower cervical stenosis. However, it is not associated with an actual deformity of the cervical spine. By contrast, neurofibromatosis, Larsen syndrome, and diastrophic dysplasia are associated with infantile cervical kyphosis. Down syndrome is associated with the risk of upper cervical instability.

Correct Answer: Achondroplasia

2130. (2282) Q5-2712:

Which of the following iliac osteotomies provides the greatest freedom of mobilization of the acetabular segment:

1) Salter osteotomy
3) Steel osteotomy
2) Pemberton osteotomy
5) Ganz osteotomy
4) Chiari osteotomy

Osteotomies that are made closest to the acetabulum provide the greatest freedom of mobilization. Of the choices provided, the Ganz or Bernese osteotomy is made closest to the acetabulum.

Correct Answer: Ganz osteotomy

2131. (2283) Q5-2713:

Displaced tibial eminence fractures contain the attachment of which of the following structures in addition to the anterior cruciate ligament:

1) The lateral meniscus
3) The posterior cruciate ligament
2) The medial meniscus
5) The fat pad
4) The patellar ligament

Displaced tibial eminence fractures have been shown by arthroscopy to routinely contain the anterior attachment of the lateral meniscus. In addition, the anterior tibial attachment of the meniscus is torn. The cruciate and the meniscus pull the fragment in different directions.

Correct Answer: The lateral meniscus

2132. (2284) Q5-2714:

A 10-year-old boy sustains a type III avulsion of the anterior tibial eminence. When his knee is placed in extension, the fragment does not reduce. Which of the following factors is likely preventing its reduction:

1) Interposed anterior horn of medial meniscus
3) Interposed cartilage flap of tibial plateau
2) Interposed stump of anterior cruciate ligament
5) Opposing pull of cruciate and lateral meniscus
4) Increased intra-articular pressure from hematoma

Type III tibial eminence fractures usually contain attachments of both the anterior cruciate ligament and the lateral meniscus. The opposing pull of both of these structures often prevents reduction during extension of the knee.

Correct Answer: Opposing pull of cruciate and lateral meniscus

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2133. (2285) Q5-2715:

A 13-year-old boy who underwent in situ fixation of slipped capital femoral epiphysis 1 year ago calls your office to complain of knee pain on the other side. He is able to bear his weight on the leg. You recommend:

1) No sports for 1 month and an office visit if the symptoms continue
3) Crutches and an office visit within 24 hours
2) An office visit within the next 2 weeks for evaluation
5) Arthroscopy of the knee
4) Magnetic resonance image of the knee and an office visit if the results are abnormal

This patient most likely has a contralateral slipped capital femoral epiphysis. It may even be in the âpreslipâ category. Acute progression to an unstable slip is possible at any time and may lead to avascular necrosis and permanent loss of motion. Therefore, urgent examination with physical examination and plain radiographs is necessary.

Correct Answer: Crutches and an office visit within 24 hours

2134. (2286) Q5-2716:

An 8-year-old boy suffers a hip dislocation while playing tackle football. His hip is reduced by closed means, and he is immobilized in abduction for a month. Radiographs at that time demonstrate a normal appearance of the hip. You recommend:

1) Discharge from follow-up
3) No sports and return to clinic in 2 months
2) Return to all sports and follow-up in 2 months
5) Femoral varus osteotomy
4) Hip abduction orthosis

This patient may suffer avascular necrosis as a result of the dislocation. Avascular necrosis may not become evident until 1 year after the accident, so continued surveillance and protection are recommended.

Correct Answer: No sports and return to clinic in 2 months

2135. (2287) Q5-2717:

Which population of patients with cerebral palsy is at greatest risk of neuromuscular hip subluxation:

1) Monoplegics
3) Spastic diplegics
2) Spastic hemiplegics
5) Athetoid
4) Total-involvement

Patients with total-involvement cerebral palsy are at the greatest risk of hip subluxation. The rate is documented to be between 25% and 60%.

Correct Answer: Total-involvement

2136. (2288) Q5-2718:

Which group of children with cerebral palsy are at greatest risk of hip subluxation after selective dorsal rhizotomy:

1) Under age 4
3) Spastic diplegics
2) Over age 10
5) Spastic hemiplegics
4) Nonambulators

Nonambulators with some degree of pre-existing hip migration are at highest risk of hip subluxation after selective dorsal rhizotomy. Patients over the age of 10 and those with hemiplegia are not typically offered selective rhizotomy.

Correct Answer: Nonambulators

2137. (2289) Q5-2719:

Which of the following muscles is most often preserved during adductor tenotomy for patients with cerebral palsy:

1) Adductor longus
3) Gracilis
2) Adductor brevis
5) Pectineus
4) Adductor magnus

Adductor tenotomy performed on patients with cerebral palsy typically involves multiple releases until abduction of more than 60Â ° is obtained. This usually begins with release of the longus, brevis, and gracilis (with the pectineus if necessary). The adductor magnus is almost never released because of its important extensor function.

Correct Answer: Adductor magnus

2138. (2290) Q5-2720:

The parameter most often recommended to follow the reciprocal relationship of the femoral head to the acetabulum in patients with cerebral palsy is known as the:

1) Migration index
3) Stulberg index
2) Epiphyseal extrusion index
5) Tonnis index
4) Acetabular index

The migration index (of Reimer) is most commonly used to track the femoral-acetabular relationship in patients with cerebral palsy because it most accurately portrays the progressive migration of the femoral head that may occur. The acetabular index only measures the acetabular response. The epiphyseal extrusion index is used for patients with Perthes disease (where the epiphysis deforms). The Stulberg index is for late outcome of Perthes, and the Tonnis index is for developmental dysplasia of the hip.

Correct Answer: Migration index

2139. (2291) Q5-2721:

The upper limit for a normal migration index in young children is less than:

1) 0%
3) 10%
2) 5%
5) 35%
4) 25%

The migration index (of Reimer) is the percentage of the femoral head lateral to the Perkins line. The index is used to quantify hip migration in patients with cerebral palsy. It is more useful than the center-edge angle because it is a linear variable angle and because the center of the aspherical, immature femoral head may be hard to accurately identify. The upper limit of a normal migration in young children is listed as 25%.

Correct Answer: 25%

2140. (2292) Q5-2722:

The acetabular sourcil is best described as:

1) The lateral articular border
3) The acetabular angle
2) The teardrop
5) A cyst forming in hip dysplasia
4) A degenerative osteophyte

The acetabular sourcil is a lateral articular border, which normally should be downsloping and below the dome of the acetabulum. In dysplastic hips, the femoral head pushes the acetabular sourcil up and gives it an upsloping shape.

Correct Answer: The lateral articular border

2141. (2293) Q5-2723:

In patients with single thoracic idiopathic scoliosis treated with posterior pedicle screw constructs, the distal extent of the fusion may be stopped at which of the following levels with respect to the neutral vertebra and still routinely maintain balance:

1) Three levels above
3) One level above
2) Two levels above
5) Two levels below
4) One level below

In single thoracic idiopathic scoliosis, the distal extent of the fusion may be stopped at one level above the neutrally rotated vertebra and still maintain trunk balance.

Correct Answer: One level above

2142. (2294) Q5-2724:

The greatest number of malpractice suits in pediatric orthopedics relates to which diagnosis:

1) Fractures
3) Spinal deformities
2) Compartment syndromes
5) Congenital anomalies
4) Tumors

The largest number of malpractice claims in pediatric orthopedics relates to fractures. This diagnosis accounts for 77% of all claims, in contrast to 57% for adults. However, the mean amount paid for each claim is lower than other diagnostic groups. Orthopedic surgeons should be aware of the issue when taking care of children with fractures.

Correct Answer: Fractures

2143. (2295) Q5-2725:

For a given femur fracture pattern and age, which method of treatment causes the longest time to union in children ages 6 to 12 years:

1) Traction and cast
3) External fixation
2) Immediate hip spica
5) Rigid nails
4) Flexible nails

External fixation produces the longest times to healing, presumably because of load-shielding. The fracture ends may also be distracted.

Correct Answer: External fixation

2144. (2296) Q5-2726:

Fractures that have a high specificity for child abuse include all of the following except:

1) Corner fractures
3) Scapular fractures
2) Rib fractures
5) Spiral femur fractures
4) Sternal fractures

Even though a spiral pattern suggests a rotational force, spiral fractures of the femur are not specific for abuse. All of the other patterns are highly specific although not absolutely diagnostic.

Correct Answer: Spiral femur fractures

2145. (2297) Q5-2727:

The differential diagnosis of abuse in a child with a long bone fracture includes all of the following conditions except:

1) Myelodysplasia
3) Rickets
2) Congenital insensitivity to pain
5) Metaphyseal dysplasia
4) Copper deficiency

All of the diagnoses except metaphyseal dysplasia place patients at increased risk of fracture, and therefore could be confused with nonaccidental injury.

Correct Answer: Metaphyseal dysplasia

2146. (2298) Q5-2728:

Among children with nonossifying fibromas, a risk of pathologic fracture exists mainly when a lesion exceeds what minimum percentage of a boneâs diameter:

1) 10%
3) 33%
2) 25%
5) 75%
4) 50%

In a series from the Mayo clinic, all pathologic fractures associated with nonossifying fibromas in the lower extremity occurred in lesions larger than 50% of the transverse diameter.

Correct Answer: 50%

2147. (2299) Q5-2729:

In a bowed tibia, the tensile stress during weightbearing is greatest at which point:

1) The apex on the convex side
3) The proximal joint surface
2) The apex on the concave side
5) There is never a tensile stress on a tibia.
4) The distal joint surface

The moment becomes tensile at the apex on the convex side of a tibial bow, in contrast to the normal compressive stress in a straight diaphysis. The moment is equal to load multiplied by distance from the axis of load.

Correct Answer: The apex on the convex side

2148. (2300) Q5-2730:

Which of the following medications has not been shown to increase the risk of osteopenia or osteoporosis:

1) Glucocorticoids
3) Phenytoin
2) Antacids containing aluminum
5) Pamidronate
4) Phenobarbital

Pamidronate, a bisphosphonate, increases bone density by inhibiting resorption. All of the medications listed as possible answers decrease bone density.

Correct Answer: Pamidronate

2149. (2301) Q5-2731:

A 7-year-old gymnast complains of pain in her medial midfoot. Radiographs reveal that the navicular is narrower and more sclerotic on this side than the other. The midfoot appears somewhat flattened. Your next step is to recommend:

1) Open biopsy
3) Percutaneous drilling
2) Electrical stimulation
5) Observation with rest as needed
4) Intravenous pamidronate

The condition described best resembles Kohlerâs disease, or avascular necrosis of the tarsal navicular. This disease has a natural history of spontaneous improvement with time, and biopsy is not needed. Rest improves symptoms, although it is probably not mandatory. Sometimes with severe pain, a cast may help to speed improvement of symptoms.

Correct Answer: Observation with rest as needed

2150. (2302) Q5-2732:

Which part of the body is removed last in a posterior vertebral column resected via a posterior approach:

1) The lamina
3) The anterior wall of the vertebral body
2) The pedicles
5) The transverse process
4) The posterior vertebral cortex

To protect and stabilize the neural elements, the posterior vertebral cortex is left intact to be resected last.Correct Answer: The posterior vertebral cortex

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2151. (2303) Q5-2733:

Slide 1

Slide 2

Slide 3

An 18-year-old man has chronic pain in his right thigh, which is foreshortened with an increased anterior bow (Slides). What is the most likely diagnosis:

1) Chronic osteomyelitis
3) Pagetâs disease
2) Osteogenesis imperfecta
5) Fibrous dysplasia
4) Multiple enchondromas

This patient has polyostotic fibrous dysplasia. The diffuse enlargement in width is atypical for osteogenesis imperfecta or infection. Pagetâs disease is associated with increased sclerosis. Enchondromas produce more localized changes in the bones than fibrous dysplasia.Correct Answer: Fibrous dysplasia

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2152. (2304) Q5-2734:

Slide 1

This infant was born with an anomaly of the left lower extremity (Slides). What is the most likely diagnosis:

1) Clubfoot
3) Fibular hemimelia
2) Proximal focal femoral deficiency
5) Congenital pseudarthrosis of the tibia
4) Tibial hemimelia

This infant has tibial hemimelia, which is a complete absence of the tibia with resultant inversion of the foot. The presence of an intact fibula causing focal lateral prominence, a shortened but complete femur, and absence of a visible tibia rule out a diagnosis of clubfoot, proximal focal femoral deficiency, fibular hemimelia, and congenital pseudarthrosis of the tibia.Correct Answer: Tibial hemimelia

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2153. (2305) Q5-2735:

Slide 1

This child with tibial hemimelia does not have a proximal tibial remnant (Slides). The preferred treatment is:

1) Knee disarticulation
3) Centralization of the fibula at the knee and ankle
2) Femoral-fibular fusion with Syme disarticulation
5) Rotationplasty
4) Syme disarticulation

If the proximal tibial remnant is absent, the prospect of a functionally useful extension at the knee is nil. Disarticulation at the knee is the best option for this patient.Correct Answer: Knee disarticulation

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2154. (2306) Q5-2736:

Slide 1 **Slide 2**

A 6-year-old girl has had a limp with minimal pain for approximately 6 months. Her radiographs are presented (Slides). She has been afebrile and thriving otherwise. The best treatment method would be:

1) Observation
3) Curettage, bone graft, and supplemental plate fixation
2) Spica cast immobilization
5) Methylprednisolone acetate injection
4) Proximal femoral resection

This patientâs limp is caused by a benign bone lesion, most likely a unicameral bone cyst. Other less likely diagnoses include an aneurysmal bone cyst and fibrous dysplasia. Treatment involves curettage of the cystic lesions, bone grafting (allograft), and supplemental fixation because of the risk of fracture and recurrence.Correct Answer: Curettage, bone graft, and supplemental plate fixation

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2155. (2307) Q5-2737:

Slide 1

Which of the following Risser signs most accurately describes the patient presented (Slide):

1) Risser 1
3) Risser 3
2) Risser 2
5) Risser 5
4) Risser 4

Despite its biologic variability, the Risser sign is one of the most useful indicators of maturity used in the management of pediatric spine disorders. The Risser sign is a depiction of the progressive ossification and fusion of the iliac apophysis, which begins anterolaterally and finishes posteromedially. The initial ossification (Risser 1) begins just after the peak height velocity, after triradiate cartilage closure, and approximately at the time of menarche. The completion of ossification and fusion usually takes 1Â½ to 2 years in girls and 2 to 3 years in boys. As the iliac apophysis matures and Risser 4 is reached, the Risser sign becomes a sclerotic line that is âwhiterâ than the adjacent ilium. Risser 0 and Risser 5 may be difficult to distinguish except that the cranial border of the ilium in Risser 0 is wavy or âruffled,â while it is smooth and sclerotic in Risser 5.Correct Answer: Risser 4

2156. (2308) Q5-2738:

Slide 1

A 15-year-old boy presents with a spinal curvature and no other known disorders (Slide). His curve is 105Â° and corrects to 70Â ° with traction. His neurologic examination is normal. The best treatment method would be:

1) Observation until medical problems develop
3) Anterior endoscopic fusion and instrumentation
2) Brace until maturity
5) Anterior and posterior fusion with posterior instrumentation
4) Anterior open fusion and instrumentation

A large, rigid curve like this requires an anterior release and fusion to obtain flexibility. The anterior release should be followed by a posterior fusion with instrumentation either on the same day or after a period of traction. Anterior instrumentation alone increases the risk of cut out and incomplete correction.Correct Answer: Anterior and posterior fusion with posterior instrumentation

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2157. (2309) Q5-2739:

Slide 1

Numerous braces are available for controlling spinal deformities in growing children. Which type of brace is presented here (Slide):

1) Boston brace
3) Milwaukee brace
2) Charleston brace
5) Providence brace
4) Wilmington brace

The Milwaukee brace is the first modern scoliosis brace to demonstrate efficacy and to achieve widespread use. The Milwaukee brace is a cervicothoracolumbar orthosis. All of the other braces listed are thoracolumbosacral orthoses.

- The Boston brace is prefabricated and is selected from measurements taken of the patient.
- The Charleston brace is a night-only brace and bends the patient to reverse the curve.
- The Wilmington brace is made of thermoplastic material for rapid, on-site fabrication.
- The Providence brace is made using computer-assisted machining to help achieve maximal correction.

Correct Answer: Milwaukee brace

2158. (2310) Q5-2740:

Slide 1

A patient has idiopathic scoliosis measuring 62Â° thoracic convex to the right and 40Â° lumbar convex to the left (Slide). The sagittal film shows a relatively decreased thoracic kyphosis and decreased lumbar lordosis. The patient is 13 years old and is 2 months postmenarchal. Which of the following treatments is most appropriate:

1) Milwaukee brace treatment
3) Posterior fusion from T4 to L3
2) Posterior fusion from T4 to L2
5) Posterior fusion from T4 to L5
4) Posterior fusion from T4 to L4

This curve may be classified as a King type II or III. The curve is too large for bracing. Only the thoracic curve must be fused. Because the stable vertebra is L2, the fusion does not need to go below this level. Other acceptable options include anterior thoracic instrumentation and fusion from T4 to T12 or posterior instrumented fusion to L1.Correct Answer: Posterior fusion from T4 to L2

2159. (2311) Q5-2741:

Slide 1

Which of the following terms best describes the condition shown (Slide):

1) Calcaneovalgus
3) Posteromedial bow
2) Equinovarus
5) Metatarsus adductus
4) Fibular hemimelia

This patientâs foot is in calcaneovalgus. Treatment is not required because calcaneovalgus spontaneously resolves.Correct Answer: Calcaneovalgus

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2160. (2312) Q5-2742:

Slide 1 **Slide 2**

A 4-year-old boy is brought to the doctor for evaluation of his feet. His mother is concerned that he has no arch. He does not have any pain in his feet, and there are no calluses on the plantar surface. Radiographs of one of the feet are shown below. You recommend:

1) Open reduction of the talocalcaneal joint
3) Calcaneal neck lengthening
2) Calcaneal slide osteotomy
5) Observation
4) Medial arch support

The radiographs demonstrate a normal appearance of a foot in a young child. The angle between the talus and calcaneus is increased at this age. The arch in a young child is not as well developed as in an older child. The navicular has not ossified yet. No treatment is needed.Correct Answer: Observation

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2161. (2313) Q5-2743:

Slide 1 **Slide 2**

A 13-year-old girl is brought to the office for evaluation of her feet. During gait, she has a foot progression angle of 45Â° outward on each side. Her transmalleolar axis is 20Â° outward on each side. Her hips have internal rotation in extension of 40Â° and external rotation in extension of 40Â°. Her clinically estimated anteversion is 20Â°. She has popliteal angles of 20Â° bilaterally and full knee extension during swing. Standing radiographs of the feet are presented. Which factor is most likely to be the cause of her toeing-out:

1) Femoral retroversion
3) Dynamic knee torsion
2) External tibial torsion
5) Tight hamstrings
4) Forefoot abduction

This patient has significant forefoot abduction demonstrated on the standing foot radiographs. The femoral anteversion of 20Â° is within normal limits for age. The transmalleolar and popliteal angles are also within normal limits. There is no evidence of dynamic knee torsion as a factor in alignment of children.Correct Answer: Forefoot abduction

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2162. (2314) Q5-2744:

Slide 1

After being dragged by an automobile, a 7-year-old child sustained injuries to his foot (Slide). Following reconstructive surgery, he is most likely to be left with a permanent deficit in which of the following:

1) Ankle inversion
3) Ankle dorsiflexion
2) Ankle eversion
5) Growth of the navicular
4) Growth of the distal tibia

This patient sustained a dorsal degloving injury. The anterior tibialis tendon is gone, as are some of the toe dorsiflexors. The anterior tibial function is difficult to reconstruct, even after tendon transfer, because of scarring at the insertion site.Correct Answer: Ankle dorsiflexion

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2163. (2315) Q5-2745:

Slide 1

What best describes the anomalies depicted (Slide):

1) Incarcerated hemivertebra
3) Congenital diastematomyelia
2) Congenital hemivertebra
5) Block vertebra
4) Congenital hemivertebrae plus bar

The Slide shows two congenital hemivertebrae on the convex side plus a bar on the right side. An incarcerated hemivertebra fits into indentations in the adjacent vertebrae, causing no net deformity. A block vertebra is a pair of fully fused vertebrae usually without significant deformity.Correct Answer: Congenital hemivertebrae plus bar

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2164. (2506) Q5-2977:

Compared to viral vectors, the advantages of non-viral vectors for gene delivery include all of the following *except*:

1) Safety
3) More efficiency
2) Less immunogenicity
5) Special packaging cell line
4) Easier production

Due to safety concerns, immunogenicity, and production issues associated with viral vectors, non-viral delivery systems were developed by complexing of genes (DNA) to various chemical formulations. This makes the DNA stable and increases its uptake. They include plasmids, peptides, cationic liposomes, DNA-ligand complexes (recognize specific cell-surface receptors, leading to receptor-mediated uptake), and gene gun (particles of gold coated with DNA, forced into the cells with high velocity bombardment). However, their efficiency is lower than viral vectors.Correct Answer: More efficiency

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2165. (2507) Q5-2978:

All of the following have been used as viral vectors for gene delivery except:

1) Adeno-associated virus
3) Herpes simplex virus
2) Rotavirus
5) Retroviral vector
4) Lentivirus

A retroviral vector derived from the Moloney murine leukemia retrovirus is among the best-developed viral vectors. Other viral vectors include adenovirus, adeno-associated virus, and herpes simplex virus. Novel vector systems based on lentivirus, a type of retrovirus, which includes human immunodeficiency virus (HIV), are being developed.Correct Answer: Rotavirus

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2166. (2508) Q5-2979:

The principle of homologous recombination in gene therapy is used to:

1) Replace a defective gene by a wild-type gene
3) Supplement a wild-type gene
2) Suppress the expression of a mutant gene
5) Replacement of a defective gene by a normal gene
4) Alter the expression of a mutant gene

Novel approaches to treating genetic diseases involve gene repair or replacement rather than gene supplementation. One such approach is based on homologous recombination (replacement of a defective gene by a normal gene).Correct Answer: Replacement of a defective gene by a normal gene

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2167. (2509) Q5-2980:

The virus associated with most immune reactions is:

1) Adeno-associated virus
3) Adenovirus
2) âGuttedâ adenovirus
5) Herpes simplex virus
4) Retrovirus

Adenoviral vectors can cause inflammatory reaction due to immune activation, an event linked to the first death related to gene therapy. This occurred in September 1999 at the University of Pennsylvania in a clinical trial in which an 18-year-old patient received infusion of over a trillion adenoviral vectors directed to his liver, which triggered a systemic inflammatory response that became uncontrollable, leading to organ failure and death. Newer generation âguttedâ or âgutlessâ adenovirus vectors are nonimmunogenic.Correct Answer: Adenovirus

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2168. (2510) Q5-2981:

Compared to ex vivo gene delivery system, the in vivo system is:

1) Technically complex
3) Safer
2) Target specific
5) More invasive
4) Less invasive

Two basic strategies exist for gene delivery. Direct, or in vivo, gene therapy involves direct introduction of vectors into the body. Indirect, or ex vivo, gene therapy involves removal of target cells from the body, vector introduction by incubation of the cells in vitro, and reimplantation. The in vivo system is less invasive.Correct Answer: Less invasive

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2169. (2511) Q5-2982:

The gene that has been studied in greatest detail for application in osteoarthritis is:

1) p-53
3) Tissue inhibitors of metalloproteinases-4
2) Interleukin (IL)-13
5) BMP-2
4) IL-Receptor antagonist

Gene therapy has been suggested as a means of delivering sustained therapeutic levels of anti-arthritic gene products to diseased joints. Local gene delivery to the synovial tissue is preferred for osteoarthritis and other conditions affecting a few joints. It is less suited to address the extra-articular components of systemic conditions, such as rheumatoid arthritis. The gene that has been studied in greatest detail encodes the human IL-1 receptor antagonist (IL-Ra).Correct Answer: IL-Receptor antagonist

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2170. (2512) Q5-2983:

The osteoinductive potential of LIM mineralization protein (LMP)-1 gene has been studied for clinical application in:

1) Fracture repair
3) Cartilage regeneration
2) Spinal fusion
5) Meniscal injury
4) Ligament healing

Identification of LIM mineralization protein-1 (LMP-1), a novel intracellular protein, is a step forward in osteoinductive proteins. Unlike BMP, which is a secreted protein that binds to cell-surface receptor to initiate a response, LMP-1 is an intracellular signaling molecule. Boden transfected bone marrow cells from rats ex vivo with LMP-1 gene using a DNA plasmid vector and used them during posterior thoracic and lumbar spine fusion in rats.Correct Answer: Spinal fusion

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2171. (2513) Q5-2984:

The gene studied for application in osteoporosis and wear-induced osteolysis is:

1) Osteoprotegerin (OPG)
3) Transforming growth factor-b1
2) Bone morphogenetic protein (BMP)
5) IL-receptor antagonist
4) LMP-1

Various cytokines and cytokine antagonists hold promise as new therapeutic agents for osteoporosis. Baltzer et al showed that intramedullary injection of Ad-IL-1Ra gene in a murine ovariectomy model strongly reduced the loss of bone mass. Using a similar model, Bolon et al studied the effect of adenovirus-mediated transfer of osteoprotegerin, which showed more bone volume with reduced osteoclast numbers in axial and appendicular bones after 4 weeks compared to sham-operated mice.Correct Answer: Osteoprotegerin (OPG)

2172. (2514) Q5-2985:

Gene transfer to a cell using viral vectors is called:

1) Transduction
3) Transformation
2) Transfection
5) Augmentation
4) Conjugation

In vivo gene delivery involves the direct injection of vectors containing the genes into the body with the expectation that they will reach and transduce the target cell.Correct Answer: Transduction

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2173. (2515) Q5-2986:

Which of the following genes has been shown to stimulate proteoglycan synthesis for prevention of disk degeneration:

1) LMP-1
3) Decorin
2) BMP-7
5) OPG
4) TGF-b1

Intervertebral disk degeneration has been associated with a progressive decrease in proteoglycan content of nucleus pulposus. The potential application of gene therapy for prevention of disk degeneration is to increase or maintain the proteoglycan content of nucleus pulposus. Thompson et al reported that addition of TGF-b1 to canine disk tissue in culture stimulated in vitro proteoglycan synthesis.Correct Answer: TGF-b1

2174. (2766) Q5-3264:

Slide 1

This patient has numerous (> 6) cafÃ© au lait spots (Slide). The most likely diagnosis is:

1) Fibrous dysplasia
3) Neurofibromatosis 1
2) Osteofibrous dysplasia
5) Osteogenesis imperfecta
4) Mazabraudâs syndrome

Neurofibromatosis is an autosomal dominant condition that occurs in a peripheral and central form. The peripheral type is more common and called neurofibromatosis 1 (NF1). The central type is characterized by bilateral acoustic neurofibromatosis (NF2). The clinical presentation is variable. Patients may either have a severe form of NF1 with hundreds of neurofibromas in the skin or they may have only cafÃ© au lait spots and deep neurofibromas that are easily apparent.

Demographics of NF1 include:

1. Autosomal dominant with high degree of penetrance
2. Chromosomal abnormality - 17, NF1 gene (encodes neurofibromin)
3. Diagnostic criteria - two or more of the following:
    - Six or more cafÃ© au lait spots
    - Two or more neurofibromas of any type or one plexiform neurofibroma
    - Freckling in the axillary or inguinal area
    - Optic glioma
    - Two or more Lisch nodules
    - Bone lesion
    - First-degree relative with NF1

Correct Answer: Neurofibromatosis 1

2175. (2767) Q5-3265:

Slide 1

This patient has numerous (> 6) cafÃ© au lait spots (Slide). Which of the following describes the correct inheritance pattern:

1) Autosomal recessive
3) Autosomal dominant with high degree of penetrance
2) Autosomal dominant with low degree of penetrance
5) X-linked dominant
4) X-linked recessive

Neurofibromatosis is an autosomal dominant condition that occurs in a peripheral and central form. The peripheral type is more common and called neurofibromatosis 1 (NF1). The central type is characterized by bilateral acoustic neurofibromatosis (NF2). The clinical presentation is variable. Patients may either have a severe form of NF1 with hundreds of neurofibromas in the skin or they may have only cafÃ© au lait spots and deep neurofibromas that are easily apparent.

Demographics of NF1 include:

1. Autosomal dominant with high degree of penetrance
2. Chromosomal abnormality - 17, NF1 gene (encodes neurofibromin)
3. Diagnostic criteria - two or more of the following:
    - Six or more cafÃ© au lait spots
    - Two or more neurofibromas of any type or one plexiform neurofibroma
    - Freckling in the axillary or inguinal area
    - Optic glioma
    - Two or more Lisch nodules
    - Bone lesion
    - First-degree relative with NF1

Correct Answer: Autosomal dominant with high degree of penetrance

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2176. (2808) Q5-3309:

The bone graft used in the Grice procedure for the treatment of neurogenic valgus feet should be placed:

1) Between the cuboid and calcaneus
3) In the sinus tarsi parallel to the axis of the tibia
2) Among the metatarsal bones
5) None of the above
4) In the calcaneus after the osteotomy

In 1945, Grice developed the use of subtalar extra-articular arthrodesis as a treatment for paralytic valgus feet. Grice demonstrated that blocking the tarsal sinus opening prevents the calcaneus from rotating posterolaterally and thus blocks the heel of a foot from shifting into the valgus position. A bone block must be placed at such an angle in the tarsal sinus that when posterolateral migration of the calcaneus is attempted, the graft compresses. If a graft is placed too far forward, then the posterolateral movement of the calcaneus increases insertional distance between blocked areas, the graft collapses, and the foot goes into valgus.Correct Answer: In the sinus tarsi parallel to the axis of the tibia

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2177. (2816) Q5-3317:

A patient with myelomeningocele has good quadriceps function, fair hamstring motion, and no active ankle movement. He has bilateral clubfoot. His motor level is:

1) L2
3) L4
2) L3
5) S1
4) L5

The hamstrings are innervated at a level just proximal to the anterior tibialis muscle (with the highest innervated ankle motor at L5). Therefore, the patientâs motor level is best estimated at L4.Correct Answer: L4

2178. (2817) Q5-3318:

In a type 1 Monteggiaâs fracture, the position of reduction is:

1) Flexion of the elbow and supination of the forearm
3) Extension of the elbow and pronation of the forearm
2) Flexion of the elbow and pronation of the forearm
5) Extension of the elbow and midposition of the forearm
4) Extension of the elbow and supination of the forearm

Type 1 Monteggiaâs fracture is associated with an anterior dislocation of the radial head and an apex anterior fracture of the ulna. Type 1 Monteggiaâs fracture is best treated by flexion and supination. The same maneuvers that reduce the ulna will also stabilize the radial head.Correct Answer: Flexion of the elbow and supination of the forearm

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2179. (2818) Q5-3319:

What is the approximate risk of growth disturbance of distal radial Salter II fractures:

1) 50%
3) 15%
2) 25%
5) 1%
4) 5%

Although distal radial physeal fractures are common, growth disturbance is rare with a 1% occurence. Growth disturbance poses a challenge for follow-up, but physicians should at least mention the risk to patients.Correct Answer: 1%

2180. (2819) Q5-3320:

Which of the following fracture situations would be most appropriate for internal fixation vs. attempted closed reduction:

1) A 7-year-old girl with 35Â° angulation of greenstick radius and ulna fracture
3) A 9-year-old girl with 30Â° angulation of complete radius and ulna fracture
2) A 7-year-old boy with 35Â° angulation of complete radius and ulna fracture
5) A 15-year-old girl with 25Â° angulation of complete radius and ulna fracture
4) A 12-year-old boy with 25Â° angulation of complete radius and ulna fracture

Remodeling potential is significantly decreased at skeletal maturity. The first four scenarios represent skeletally immature patients. The 15-year-old girl should be treated like an adult to achieve the most acceptable result. All other patients deserve an attempt at closed reduction.Correct Answer: A 15-year-old girl with 25Â° angulation of complete radius and ulna fracture

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2181. (2820) Q5-3321:

All of the following may be signs and symptoms of a tethered cord except:

1) Back pain
3) Meryonâs sign
2) Leg pain
5) Increasing motor weakness
4) Increasing contracture

A tethered cord is common in patients with myelomeningocele. A tethered cord occurs due to adhesion of the dysplastic distal cord to its surrounding structures. The onset of a tethered cord may be exacerbated by closure of the open cord. Signs and symptoms of a tethered cord may include back pain, leg pain, increasing motor weakness, and increasing contracture. Alternate explanations for some of these signs and symptoms exist as well.

An adult with Meryon's sign may drop a child he or she is holding due to weakness of the pectorals and latissimus muscles. Meryon's sign is also common in patients with myelomeningocele who have a Chiari's malformation. In this case, the patient with myelomeningocele does not experience weakness of the pectorals and latissimus muscles due to a tethered cord. Meryon's sign also occurs in some myopathies.

Correct Answer: Meryonâs sign

2182. (2821) Q5-3322:

A 15-year-old patient with osteogenesis imperfecta (OI) is examined due to increasing knee flexion contractures and generalized muscle tightness of the lower extremities. The most likely explanation for these symptoms is:

1) Spondylolysis
3) Osteoarthritis associated with OI
2) Scoliosis
5) Disuse
4) Basilar invagination

Patients with OI have a significant risk of basilar invagination. In patients with OI the skull settles around the foramen magnum and cervical spine, causing the brainstem to become indented. Signs and symptoms include increased spasticity (described here as muscle tightness), contractures, hyperreflexia, clonus, respiratory depression, and changes in voice or swallowing. Basilar invagination is most common in type IV OI. Although osteoarthritis is more common in patients with OI than in the general population at a given age, the 15-year-old patient in this case is too young to develop osteoarthritis. Spondylolysis would not produce this constellation of symptoms unless associated with severe listhesis.Correct Answer: Basilar invagination

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2183. (2822) Q5-3323:

A 6-year-old boy with osteogenesis imperfecta has had three fractures of his proximal femur resulting in progressive bowing, which has now reached 70Â°. He has pain in his thigh and a sclerotic stress line at the apex of the bow. The best treatment is:

1) Closed osteoclasis and spica cast
3) Osteotomy and plate fixation
2) Osteoclasis and external fixator
5) Observation
4) Osteotomy and internal fixation with an expandable rod

As bowing becomes greater, the likelihood of a re-fracture increases. The presence of a lucent sclerotic line and pain increases the risk of re-fracture. Intramedullary fixation is preferred to plate fixation because plate fixation increases the risk of stress risers. Expandable rods that bridge the entire bone from one epiphysis to the other are the best treatment for excessive bowing. Examples include the Bailey Dubow or the Fassier rods.Correct Answer: Osteotomy and internal fixation with an expandable rod

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2184. (2823) Q5-3324:

A 10-year-old boy steps on a nail. The nail is promptly removed and inspected in the emergency department. No evidence of foreign material is found in the patientâs foot. One week later, the boy develops increased pain and swelling in his foot with inability to bear weight. Plain films show no abnormality. The appropriate next step of treatment would be:

1) Irrigation and debridement of the foot
3) Bone scan
2) Magnetic resonance imaging (MRI) of the foot
5) Repair of flexor tendon laceration
4) Computed tomography scan

Penetrating injuries to the sole of the foot commonly inoculate bacteria to the deep spaces of the foot. *Pseudomonas*, other gram-negative organisms, and *Staphylococcus* are examples of bacteria that commonly can become inoculated. An MRI would help to localize the site and stage of the infection. The MRI determines whether the surgeon should aspirate the infection and treat it with antibiotics or operatively debride the infection. *Pseudomonas* often requires debridement.Correct Answer: Magnetic resonance imaging (MRI) of the foot

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2185. (2824) Q5-3325:

Which of the following is not a typical characteristic of Scheuermannâs kyphosis:

1) Endplate irregularity
3) Narrowing of disk space
2) Wedging of three vertebrae
5) Curve apex at or above T8
4) Schmorlâs nodes

Scheuermannâs kyphosis may affect any region of the thoracic spine; it also may affect the thoracolumbar junction or the lumbar spine. Endplate irregularity, wedging of three vertebrae, narrowing of disk space, and Schmorlâs nodes are characteristic of Scheuermannâs kyphosis.Correct Answer: Curve apex at or above T8

2186. (2825) Q5-3326:

A 17-year-old boy presents with thoracic kyphosis. He has minimal discomfort in his back. Radiographs show a 62Â° Scheuermannâs kyphosis, with wedging of T8-T10. His Risser sign is 4, and his Tanner stage is 4. He states that he is not cosmetically aware of his kyphosis. Recommended treatment includes:

1) A Milwaukee brace
3) A posterior spine fusion
2) A Boston brace
5) Observation
4) An anterior and posterior spine fusion

This patient is too skeletally mature to benefit from bracing. Bracing is not likely to change the natural history of the curve at maturity. Surgery is indicated if a patient experiences pain or dissatisfaction with the appearance of the back. Otherwise, the natural history is benign and observation is indicated.Correct Answer: Observation

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2187. (2826) Q5-3327:

Adults with untreated Scheuermannâs kyphosis do not differ from controls in terms of this parameter:

1) Pulmonary function
3) Activity levels in job
2) Severity of back pain
5) Presence of scoliosis
4) Location of greatest backache

Patients with Scheuermannâs kyphosis have no decrease in pulmonary function compared to controls; however, they have increased severity of back pain, seek jobs with lower activity levels, and have more thoracic back pain and less trunk extension. They also have a 30% incidence of scoliosis of less than 35Â°.Correct Answer: Pulmonary function

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2188. (2827) Q5-3328:

Correction of Scheuermannâs kyphosis from a posterior approach involves this mechanical principle:

1) Compression of the posterior column of the spine
3) Transverse approximation
2) Distraction of the posterior column
5) Hemiepiphyseodesis
4) Rod rotation

Compression of the posterior column is the principal method of correcting Scheuermannâs kyphosis. Compresssion is usually achieved by resecting portions of the elongation.Correct Answer: Compression of the posterior column of the spine

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2189. (2828) Q5-3329:

A 13-year-old boy has a Scheuermannâs kyphosis of 68Â°, apex at T8. His Risser sign is 1. His mother is concerned about his appearance and possible future progression. Recommended treatment includes:

1) A Milwaukee brace
3) A posterior spine fusion
2) Exercise
5) Observation
4) An anterior and posterior spine fusion

Brace treatment for Scheuermannâs kyphosis is successful in decreasing the kyphosis, usually permanently, by 10Â° to 20Â° if worn properly. A patientâs Risser sign must be below 3. Because this patient has a Risser sign of 1, bracing is appropriate treatment. The Milwaukee brace is the most effective type of brace for kyphosis. However, the Boston brace is also somewhat effective in treating patients with Scheuermannâs kyphosis because it corrects the compensatory lordosis and stimulates active correction of the thoracic curve.Correct Answer: A Milwaukee brace

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2190. (2829) Q5-3330:

Slide 1

The mother of a 4-month-old boy brings him to a physician to be evaluated for a swollen leg (Slide). The most likely diagnosis is:

1) Rickets
3) Scurvy
2) Osteogenesis imperfecta (OI)
5) Caffeyâs disease
4) Nonaccidental injury

This radiograph shows two fractures in different stages of healing. Note the old femur fracture at the top of the field. No evidence of decreased cortical thickness, diaphyseal thinning, or bowing suggests OI. The physis of the distal femur and proximal femur show no signs of rickets. The presence of fractures rather than periosteal reaction make Caffeyâs disease unlikely. The fractures in scurvy are more commonly located in the physis. The diagnosis of nonaccidental injury should be made only after performing a thorough patient history and physical.Correct Answer: Nonaccidental injury

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2191. (2830) Q5-3331:

Which of the following is not a contraindication to the repair of a spondylolytic defect:

1) Age older than 35 years
3) Disk degeneration at the same level
2) Slip greater than 25%
5) Minimal symptoms
4) Bilateral pars defect

Repair of a spondylolytic defect is usually a successful procedure for relieving symptoms. Repair is not indicated in patients older than 35 years of age. Repair should not be done if there is a significant slip over a grade 1 at most or if the patient has minimal, tolerable symptoms or has symptoms complicated by a degenerative disk at the same level.Correct Answer: Bilateral pars defect

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2192. (2831) Q5-3332:

A 14-year-old boy has grade 1 isthmic L5-S1 spondylolisthesis. He has no back pain and wants to play football. The patient should be advised to:

1) Play football if his condition is treated by grafting and wiring
3) Play football if he wears a lumbosacral orthosis during all games
2) Play football if he has a L5-S1 fusion
5) Play football as desired
4) Not play football at all

Asymptomatic spondylolisthesis occurs in approximately 5% of the pediatric population. Slips of up to grade 1 develop in at least one third of patients with asymptomatic spondylolisthesis. Most patients with asymptomatic spondylolisthesis are minimally symptomatic or asymptomatic. The patient presented in this scenario may be allowed to play football as long as he understands that he may develop symptoms.Correct Answer: Play football as desired

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2193. (2832) Q5-3333:

Most cases of L5 spondylolysis develop in patients by:

1) Birth
3) Age 6 years
2) Age 3 years
5) Age 12 years
4) Age 9 years

A study was conducted to monitor the development of L5 spondylolysis in patients from birth to 6 years of age. The study showed that no cases of L5 spondylolysis were present at birth in any of the patients. The majority of the patients developed L5 spondylolysis by the time they had reached 6 years of age. A 45-year follow-up study showed that none of the 30 patients had more than a 40% slip and that only 1 patient required fusion.Correct Answer: Age 6 years

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2194. (2833) Q5-3334:

Patients with high-grade spondylolisthesis develop a vertical position of the sacrum in response to which condition:

1) Lumbar lordosis
3) Olisthetic scoliosis
2) Tight hamstrings
5) Lumbosacral kyphosis
4) Lumbar kyphosis

As spondylolisthesis progresses to a high grade, the fifth lumbar vertebra shifts forward into a kyphotic position termed a slip angle. The slip angle can reach a value of more than 30Â° and results in verticalization of a patientâs sacrum to decrease force on the involved vertebra.Correct Answer: Lumbar kyphosis

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2195. (2834) Q5-3335:

Which of the following is not a feature of Klippel-TrÃ©naunay-Weber syndrome:

1) Varicose veins
3) Increased length of the involved limb
2) Cutaneous nevus
5) Seizure disorder
4) Increased width of the involved limb

Klippel-TrÃ©naunay-Weber syndrome is a constellation of varicose veins, cutaneous nevus, and an increase in the length or width of the involved limb. Seizure disorder is a feature of von Hippel- Lindau disease.Correct Answer: Seizure disorder

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2196. (2835) Q5-3336:

Epiphyseal osteochondroma is also known as:

1) Mafucciâs syndrome
3) Larsen-Johansson disease
2) Freibergâs fracture
5) Iselinâs disease
4) Trevorâs disease

Epiphyseal osteochondroma is also known as Trevorâs disease. Epiphyseal osteochondroma is localized to a specific region of the body, unlike multiple osteochondroma, which affects the entire body. Epiphyseal osteochondroma and multiple osteochondroma are unrelated disorders.Correct Answer: Trevorâs disease

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2197. (2836) Q5-3337:

All of the disorders listed below are examples of osteochondrosis except:

1) Legg-CalvÃ©-Perthes disease
3) Osgood Schlatter disorder
2) Scheuermannâs disease
5) Blount disease
4) Gorhamâs disease

The term osteochondrosis refers to symptomatic disorders involving cartilage growth. Cartilage affected by osteochondrosis may be epiphyseal, physeal, or apophyseal. Gorhamâs disease is not an example of osteochondrosis. Gorhamâs disease is a lymphatic disorder known as disappearing bone disease.Correct Answer: Gorhamâs disease

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2198. (2837) Q5-3338:

Which of the following symptoms is not characteristic of congenital constriction band syndrome:

1) Circular grooves in the limb
3) Terminal amputations
2) Complex complete syndactyly
5) Lymphedema
4) Clubfoot

Syndactyly in constriction band syndrome is a fenestrated syndactyly, is incomplete, and has slits between the digits proximally. Syndactyly in constriction band syndrome is also not complex because the bones are not fused.Correct Answer: Complex complete syndactyly

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2199. (2838) Q5-3339:

Which of the following conditions requires an ultrasound of the abdomen:

1) Russell-Silver syndrome
3) Idiopathic hemihypertrophy
2) Camurati-Engelmann disease
5) Blue rubber bleb nevus syndrome
4) Congenital constriction band syndrome

An ultrasound of the abdomen is indicated for patients with idiopathic hemihypertrophy to determine the development of Wilmsâ tumor. Children with idiopathic hemihypertrophy have an increased incidence of Wilmsâ tumor. Children require periodic monitoring, and they should have an abdominal ultrasound 2 to 3 times per year until 8 years of age.Correct Answer: Idiopathic hemihypertrophy

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2200. (2839) Q5-3340:

How often should patients with hemihypertrophy have an abdominal ultrasound:

1) Once at 2 years old
3) Two to three times per year until 8 years old
2) Yearly until 5 years old
5) Yearly until 18 years old
4) Quarterly until 18 years old

Patients with idiopathic hemihypertrophy require periodic monitoring to determine the risk of Wilmsâ tumor. The best method to monitor patients with idiopathic hemihypertrophy is a renal ultrasound two to three times per year until the patient is 8 years of age.Correct Answer: Two to three times per year until 8 years old

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2201. (2840) Q5-3341:

Which of the following rays is most commonly used to treat patients with macrodactyly of the foot:

1) First
3) Third
2) Second
5) Fifth
4) Fourth

The second ray is most commonly used to treat patients with macrodactyly of the foot. The third ray is the next most commonly used ray in treating patients with macrodactyly of the foot.Correct Answer: Second

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2202. (2841) Q5-3342:

Macrodactyly of the foot commonly displays which of the following patterns of overgrowth:

1) Greatest dorsally and distally
3) Greatest plantarly and proximally
2) Greatest plantarly and distally
5) Greatest medially and proximally
4) Greatest laterally and distally

Macrodactyly displays overgrowth that is greatest plantarly and distally. Plantar overgrowth causes the sole to become convex plantarly and the toes to become dorsiflexed.Correct Answer: Greatest plantarly and distally

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2203. (2842) Q5-3343:

A 1-year-old patient presents with a pseudarthrosis of the left clavicle. Which of the following conditions is most likely to coexist with pseudarthrosis of the left clavicle:

1) Neurofibromatosis
3) Osteogenesis imperfecta
2) Proteus syndrome
5) Dextrocardia
4) Fibrous dysplasia

Almost all cases of congenital pseudarthrosis involve the right clavicle. Cases of congenital pseudarthrosis involving the left clavicle often coexist with dextrocardia. Patients with pseudarthrosis of the clavicle respond well to standard orthopedic treatment, unlike patients with congenital pseudarthrosis of the tibia.Correct Answer: Dextrocardia

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2204. (2843) Q5-3344:

A 14-year-old girl presents with a swollen foot. She had sustained a contusion to the dorsum of her foot for 4 weeks. Her temperature is 99.2Â° F. Her foot is tender to touch. She is able to dorsiflex and plantarflex her toes. Radiographs are normal. The best treatment is:

1) Physical therapy
3) Sciatic block
2) Ankle block
5) Blood culture
4) Ankle joint aspiration

This patient demonstrates signs of early reflex sympathetic dystrophy. She may later develop osteopenia, a positive bone scan, and contracture. Physical therapy is the best treatment for reflex sympathetic dystrophy in this case because it will increase the patientâs range of movement and her tolerance to touch. Multimodality therapy is also required to treat reflex sympathetic dystrophy. Analgesics may be appropriate treatment for the patient and can be supplemented by antidepressants, if needed. Repeated regional block treatment is recommended for patients with established cases of reflex sympathetic dystrophy.Correct Answer: Physical therapy

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2205. (2844) Q5-3345:

Slide 1

A 10-year-old girl injured her neck (Slide) after falling and hitting her head. Recommended treatment includes:

1) Anterior fusion C6-T1 with plate fixation
3) Anterior and posterior fusion C6-T1 with plate fixation
2) Posterior fusion C6-T1 with plate fixation
5) Cervicothoracic orthosis
4) Halo vest immobilization

The patient has an anterior compression fracture of C7, which can be treated by cervicothoracic orthosis. Halo vest immobilization improves control of the head and upper cervical spine but is unnecessary treatment in this patientâs case. Although an anterior operation is an optional treatment for an anterior compression fracture, it is also unnecessary in this patientâs case.Correct Answer: Cervicothoracic orthosis

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2206. (2845) Q5-3346:

Slide 1

Which of the following conditions is represented in the radiograph (Slide):

1) Spina bifida of the first lumbar vertebra
3) Burst fracture
2) Diastematomyelia
5) Flexion-rotation injury
4) Chance fracture

This radiograph demonstrates a chance fracture. The posterior elements of the spine are separated, as indicated by the transverse fracture of the transverse processes, pedicles, and lamina. There is no significant element of rotation of the spine.Correct Answer: Chance fracture

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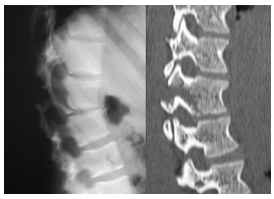
2207. (2846) Q5-3347:



Slide 1

A 15-year-old girl experienced an injury of L1 during a sledding accident (Slide). Her neurologic examination is normal. The best treatment is:

1) Thoracolumbosacral orthosis
3) Reduction and posterior fusion of T12-L1 with pedicle screws
2) Hyperextension cast
5) Reduction and posterior fusion of T12-L2 with pedicle screws
4) Corpectomy of T12 and anteroposterior instrumented fusion

This patient has a Chance fracture of L1, which is indicated by the compression of the anterior portion of L1 and the distraction of the posterior portion of L1. A hyperextension cast will not treat the patientâs Chance fracture completely. Operative treatment is needed to remove residual kyphosis at the thoracolumbar junction. Posterior column compression will also likely reduce the presence of residual kyphosis. Posterior fusion of T12-L2 with pedicle screws results in the best angular correction for a patient with a Chance fracture of L1. T12-L1 with hooks is an optional treatment for patients with a Chance fracture of L1 because residual kyphosis may persist even if the inferior lamina of L1 is intact.Correct Answer: Reduction and posterior fusion of T12-L2 with pedicle screws

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2208. (2847) Q5-3348:

Slide 1

Which of the following conditions is represented in this radiograph (Slide) of a childâs neck:

1) Osteoid osteoma of C1
3) Rotatory subluxation
2) Jeffersonâs fracture
5) Os odontoideum
4) Hangman fracture

This radiograph indicates a rotatory subluxation of a childâs neck. Alteration of the cortical ring of the anterior atlas is present and superimposed on the lateral mass of atlas. Increased distance between the anterior atlas and axis is the result of rotation.Correct Answer: Rotatory subluxation

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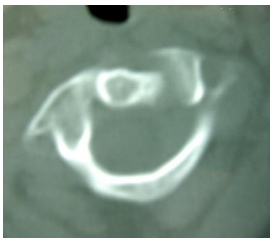
2209. (2848) Q5-3349:



Slide 1

Which of the following conditions is represented by this computed tomography scan of a cervical spine (Slide):

1) Jeffersonâs fracture
3) Odontoid fracture
2) Osteoid osteoma
5) Chiariâs malformation
4) Rotatory subluxation

Partial superimposition of C1 on C2 is present in this radiograph. C2 is the portion in the center of the frame. C1 and C2 would normally be on different cuts of a scan but are superimposed because the atlas overlaps the axis as it falls forward. If an imaginary line is drawn between the vertebral foramena of C1 and across the body of C2, an angle will form representing the degree of malrotation, which is approximately 30Â°.Correct Answer: Rotatory subluxation

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2210. (2849) Q5-3350:

Which of the following conditions is not commonly associated with Chance fractures in children:

1) Renal trauma
3) Dural tear
2) Intestinal contusion
5) Multilevel spine trauma
4) Neurologic injury

Chance fractures in children are often associated with blunt contusions to abdominal structures. Blunt contusions to abdominal structures cause renal and intestinal trauma and distraction of the spinal cord and may be associated with dural tearing or neurologic injury. Neurologic injuries occur in fewer than half of children with Chance fractures that have blunt contusions to abdominal structures. Although spinal fractures caused by falls or axial loads can result in multilevel spinal injuries, multilevel spinal injuries do not commonly result from Chance fractures.Correct Answer: Multilevel spine trauma

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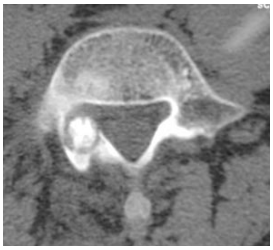
2211. (2850) Q5-3351:



Slide 1

The lesion indicated in this computed tomography (Slide) most likely represents:

1) Brodieâs abscess
3) Osteosarcoma
2) Eosinophilic granuloma
5) Osteoma
4) Osteoid osteoma

This patient has an osteoid osteoma with pain in the lumbar spine where the lesion is located. The patientâs osteoid osteoma shows hot on a photon emission computed tomography scan and is relieved by nonsteroidal anti-inflammatory agents. Most patients with osteoid osteoma with lesions have them in the posterior region of their vertebrae.Correct Answer: Osteoid osteoma

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2212. (2851) Q5-3352:

Slide 1

Which of the following conditions is represented by this radiograph (Slide) of an infantâs elbow:

1) Salter I fracture of distal humerus
3) Type 2 Monteggiaâs fracture dislocation
2) Elbow dislocation
5) Proximal radioulnar synostosis
4) Septic elbow

This patient has a proximal radioulnar synostosis. Patients with proximal radioulnar synostosis often have dysplasia of the proximal ulna, maldirection of the proximal radius, and cortical continuity of the ulna and radius.Correct Answer: Proximal radioulnar synostosis

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2213. (2852) Q5-3353:

Slide 1

Which of the following conditions is represented by this radiograph (Slide):

1) Developmental dysplasia of the hip
3) Hemophilic arthropathy
2) Juvenile rheumatoid arthritis
5) Rickets
4) Legg-CalvÃ©-Perthes disease

This patient has early fragmentation, epiphyseal flattening, metaphyseal lucency and widening, and sclerosis typical of patients with Legg-CalvÃ©-Perthes disease in the early stages.

In patients with juvenile rheumatoid arthritis, osteopenia and joint space narrowing are present, whereas in patients with developmental dysplasia, the acetabulum is shallow.

Correct Answer: Legg-CalvÃ©-Perthes disease

2214. (2853) Q5-3354:

Slide 1

Which of the following designations best describes this radiograph (Slide):

1) Herring antibody
3) Stulberg 4
2) Herring body
5) 30% epiphyseal extrusion
4) Catterall 1

This patient has Herring body involvement of the hip. As a result, this patient has less than a 50% loss of lateral column height and is in the early fragmentation phase. This patient has a Catterall involvement of at least 3. The Stulberg classification is used to rate a patientâs hip after it has healed.Correct Answer: Herring body

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2215. (2854) Q5-3355:

Slide 1

In which stage of Legg-CalvÃ©-Perthes disease is this patient:

1) Initial
3) Reossification
2) Fragmentation
5) Degenerative
4) Healed

This patient is in the end of the fragmentation phase of Legg-CalvÃ©-Perthes disease. Note the extreme flattening of the head and the lateral fragmentation.Correct Answer: Fragmentation

---

2216. (2855) Q5-3356:

Slide 1

All of the following conditions are indicated by this radiograph (Slide) of a patient with Legg- CalvÃ©-Perthes disease except:

1) Coxa magna
3) Trochanteric overgowth
2) Coxa brevis
5) Coxa plana
4) Coxa vara

The hip of this patient with Legg-CalvÃ©-Perthes disease has undergone epiphyseal flattening and premature (primarily lateral) physeal arrest. The femoral head has regrown with an enlarged width. The radiograph shows elements of coxa magna, coxa brevis, trochanteric overgrowth, and coxa plana. Coxa vara is not present.Correct Answer: Coxa vara

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2217. (2856) Q5-3357:

A 5-year-old girl is evaluated for Legg-CalvÃ©-Perthes disease. She is in the fragmentation phase, and rotation is 10Â° internal and 15Â° external. Her epiphyseal extrusion index is 15%. Recommended treatment includes:

1) Femoral osteotomy
3) Traction
2) Iliac osteotomy
5) Observation
4) Shelf procedure

The patientâs restricted range of motion is normal for a patient in the fragmentation phase of Legg-CalvÃ©-Perthe disease. The patientâs degree of epiphyseal extrusion is not extreme. Observation is the most appropriate course of treatment.Correct Answer: Observation

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2218. (2857) Q5-3358:

What is the risk of hip arthroplasty for 50-year-old patients with Legg-CalvÃ©-Perthes disease:

1) 10%
3) 33%
2) 25%
5) 75%
4) 50%

Long-term study has shown that 50% of 50-year-old patients with Legg-CalvÃ©-Perthes disease will have degenerative changes in their hips significant enough to make them candidates for hip arthroplasty.Correct Answer: 50%

2219. (2858) Q5-3359:

Which of the following descriptions reflects all transverse-plane factors affecting the position of the patientâs foot during gait:

1) Thigh-foot angle
3) Foot progression angle
2) Transmalleolar axis
5) Femoral anteversion
4) Heel bisector

The foot-progression angle is a reflection of all transverse-plane factors affecting the position of the patientâs foot during gait.Correct Answer: Foot progression angle

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2220. (2859) Q5-3360:

In which of the following conditions is a Trendelenburgâs gait unlikely to occur:

1) L4 myelomningocele
3) Untreated developmental dysplasia of the hip
2) Legg-CalvÃ©-Perthes disease
5) Osgood-Schlatter disease
4) Polio- L5

Patients with complications that cause pain around their hips or that decrease the abductor strength of their hips may develop a Trendelenburgâs gait.Correct Answer: Osgood-Schlatter disease

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2221. (2860) Q5-3361:

In which muscle does Elyâs test detect spasticity or contracture:

1) Biceps femoris
3) Gastrocnemius
2) Rectus femoris
5) Semimembranosus
4) Soleus

Elyâs test is performed while the patient is prone and his or her hip is at maximal extension. Elyâs test is positive if flexion of the patientâs knee causes the patientâs hip to flex. A positive Elyâs test indicates spasticity or contracture of the rectus femoris.Correct Answer: Rectus femoris

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2222. (2861) Q5-3362:

Staheliâs test is designed to detect hip flexion contracture. Which of the following tests also detects hip flexion contracture:

1) SilfverskiÃ¶ldâs test
3) Thomas test
2) Oberâs test
5) Trendelenburgâs test
4) Jackâs test

Staheliâs test and the Thomas test are designed to detect hip flexion contracture. Staheliâs test is performed with a patient in the prone position. The lumbar lordosis is eliminated by flexing a patientâs hips, and then gradually extending the affected hip. The Thomas test is performed with a patient in the supine position. The lumbar lordosis is minimized by flexing a patientâs hips forward, allowing the affected hip to go into extension.Correct Answer: Thomas test

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2223. (2862) Q5-3363:

Which of the following conditions has the highest rate of bilaterality:

1) Slipped capital femoral epiphysis
3) Developmental dysplasia of the hip
2) Legg-CalvÃ©-Perthes disease
5) Fibular hemimelia
4) Discoid lateral meniscus

Slipped capital femoral epiphysis has a bilaterality rate of 25% to 40%. Legg-CalvÃ©-Perthes disease, developmental dysplasia of the hip, discoid lateral meniscus, and fibular hemimelia have bilateral rates of less than 20%.Correct Answer: Slipped capital femoral epiphysis

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2224. (2863) Q5-3364:

In which pattern does the most common presentation of Trevorâs disease occur:

1) Generalized involvement of all extremities
3) Proximal lateral areas of both lower extremities
2) Distal medial areas of one lower extremity
5) Proximal lateral areas of one upper extremity
4) Distal medial areas of both upper extremities

Trevorâs disease, also known as dysplasia epiphysialis hemimelia, refers to epiphyseal osteochondromas. Epiphyseal osteochondromas are usually few in number and are more common on the distal and medial portions of the epiphysis of one lower extremity.Correct Answer: Distal medial areas of one lower extremity

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2225. (2864) Q5-3365:

At which age do patients most commonly present with dysplasia epiphysialis hemimelia (DEH):

1) Birth
3) Early adulthood
2) Between early childhood and early teen years
5) Older than 60 years
4) Middle age

Most cases of DEH occur in patients between early childhood and early teen years. Dysplasia epiphysialis hemimelia does not present at birth.Correct Answer: Between early childhood and early teen years

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2226. (2865) Q5-3366:

Slide 1

This radiograph (Slide) shows an 11-month-old girl with a Tonnis 3 developmental dislocation of the hip. Recommended treatment includes:

1) Pavlik harness
3) Open reduction and spica cast application
2) Closed reduction and spica cast application
5) Open reduction with Salter osteotomy
4) Open reduction with femoral shortening derotation osteotomy

Closed reduction and spica cast application is the best treatment for this patient with a Tonnis 3 developmental dislocation of the hip. Open reduction and spica cast application introduces additional risks of infection and vascular compromise and should not be performed unless closed reduction and spica cast application fails. This patient is too old to be controlled by a Pavlik harness.Correct Answer: Closed reduction and spica cast application

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2227. (2866) Q5-3367:

The mechanical axis of the lower extremity is defined as the angle formed by lines drawn from the center of the hip to the center of the knee to the center of the ankle. The resulting value should be:

1) 15Â°
3) 7Â°
2) 10Â°
5) 0Â°
4) 5Â°

The mechanical axis should be 0Â°. Alignment following correctional osteotomies and arthroplasties must re-establish the mechanical axis.Correct Answer: 0Â°

2228. (2867) Q5-3368:

A 2-year-old boy presents with intoeing. An examination shows that his feet form an angle of 20Â° inward with the direction he is walking. Which of the following parameters describes his condition:

1) Thigh-foot angle
3) Angle of femoral anteversion
2) Tibial torsion angle
5) Transmalleolar axis
4) Foot progression angle

The 20Â° inward angle formed with the direction the patient is walking is a foot progression angle. This angle encompasses all factors influencing position and progression of the lower extremity during gait.Correct Answer: Foot progression angle

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2229. (2868) Q5-3369:

Which of the following measurements reflects the mean lateral distal femoral joint angle with respect to the mechanical axis:

1) 90Â°
3) 84Â°
2) 87Â°
5) 78Â°
4) 81Â°

The lateral distal femoral angle with respect to the mechanical axis is 87Â°.Correct Answer: 87Â°

2230. (2869) Q5-3370:

A 2-year-old patient presents with bowed legs. The metaphyseal diaphyseal angle is 17Â°, and the mechanical axis shows 15Â° of varus bilaterally. The varus appears to be in the proximal tibia. No evidence of metabolic disease or dysplasia is present. Recommended treatment inlcudes:

1) Observation
3) High tibial osteotomy
2) Knee-ankle-foot orthosis
5) Percutaneous hemiepiphysiodesis with drill
4) Medial staple hemiepiphysiodesis

This patient has infantile Blount disease. Brace treatment is appropriate to try, although it is not always successful. The best treatment is for the patient to wear a knee-ankle-foot brace full-time. High tibial osteotomy, medial staple hemiepiphysiodesis, and percutaneous hemiepiphysiodesis are inappropriate treatments for this patient at 2 years old. If the varus does not improve by the time the patient is 3.5 years old to 4 years old, then high tibial osteotomy should be performed.Correct Answer: Knee-ankle-foot orthosis

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2231. (2870) Q5-3371:

A newborn infant presents with a knee complication. The patientâs knee hyperextends to 30Â° and flexes to 30Â°. The neurovascular examination is normal, and the patientâs hips are stable. No other skeletal complications are found. Radiographs show a line along the axis of the tibia intersecting the ossific nucleus of the distal femur, signaling significant hyperextension. Recommended treatment inlcudes:

1) Observation
3) Pavlik harness
2) Serial casting
5) Open reduction of the knee with V-Y plasty
4) Prone skin traction to gradually flex the leg

This patient has a hyperextensible, but not dislocated, knee. In the radiograph, the line along the axis of the tibia would intersect the femur anterior to the ossific nucleus if the patientâs knee were dislocated. Hyperextensible knee is an in utero complication and resolves without treatment.Correct Answer: Observation

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2232. (2871) Q5-3372:

A 12-year-old girl has genu valgum and requests correction. Radiographs reveal 12Â° valgus of the mechanical axis, with 2Â° arising in the distal femur and 3Â° arising in the proximal tibia. No evidence of other disorders are present. Recommended treatment includes:

1) Observation
3) Medial distal femur staple hemiepiphysiodesis
2) Knee-ankle-foot orthosis worn at night
5) Medial closing wedge osteotomy of the proximal tibia
4) Lateral opening wedge osteotomy of the distal femur

This patient has a significant amount of valgus. Valgus at the knee is evident when signaled by even a low number of degrees. The patient is at an age when medial distal femur staple hemiepiphysiodesis would be the best treatment for genu valgum. Medial distal femur staple hemiepiphysiodesis is a safe and effective procedure and is performed using small incisions, which allow for immediate ambulation.Correct Answer: Medial distal femur staple hemiepiphysiodesis

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2233. (2872) Q5-3373:

Which of the following conditions is not part of the differential diagnosis of a valgus knee in a 4-year-old child:

1) Physiologic valgus
3) Multiple exostoses
2) Prior proximal metaphyseal fracture
5) Infantile Blount disease
4) Chondroectodermal dysplasia

Physiologic valgus, prior proximal metaphyseal fracture, multiple exostoses, and chondroectodermal dysplasia produce valgus. Infantile Blount disease produces varus.Correct Answer: Infantile Blount disease

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2234. (2873) Q5-3374:

Which of the following methods of treatment has the lowest success rate in treating patients with congenital pseudarthrosis of the tibia:

1) Electromagnetic stimulation
3) Ilizarovâs method
2) Vascularized fibula graft
5) Ilizarovâs method over an intramuscular rod
4) Intramedullary (IM) rod fixation and bone graft

Electromagnetic stimulation has the lowest success rate in treating patients with congenital pseudarthrosis of the tibia. Vascularized fibula graft, Ilizarovâs method, IM rod fixation and bone graft, and Ilizarovâs method over an intramuscular rod have similar success rates.Correct Answer: Electromagnetic stimulation

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2235. (2874) Q5-3375:

Which of the following methods of measuring limb length inequality includes the greatest number of factors leading to pelvic height difference:

1) Scanogram
3) Tape method
2) Orthoroentgenogram
5) Teleroentgenogram
4) Block method

The block method consists of adding height to the short limb in blocks until the pelvis is level. The block method measures differences in foot height and pelvic size as well as inequalities of the long bones. Because the teleroentgenogram shows the whole limb in one exposure, the exposure is susceptible to be parallax and distorted at the ends. The orthoroentgenogram and scanogram measure limb length inequality similarly, but the scanogram captures only the joints and eliminates the diaphyses.Correct Answer: Block method

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2236. (2875) Q5-3376:

A patient with myelomeningocele is a community ambulator. She has a minimal Trendelenburgâs sign but has a calcaneus gait. Her motor level is:

1) L2
3) L4
2) L3
5) S1
4) L5

A calcaneus gait describes heel strike with no pushoff. This patient has active anterior tibialis with no gastrocsoleus. The Trendelenburgâs test shows that her gluteals are minimal at less than L4. The patientâs motor level is L5.Correct Answer: L5

2237. (2876) Q5-3377:

An 8-year-old child with spina bifida has a focal kyphosis measuring 100Â° with an apex at the first lumbar vertebra and a short trunk. The patientâs family is concerned about the childâs risk of skin breakdown posteriorly. Recommended treatment includes:

1) Milwaukee brace
3) Posterior fusion in situ to produce correction with growth
2) Correction in a hyperextension cast followed by a Milwaukee brace
5) Posterior vertebral excision and instrumentation
4) Anterior strut grafting

This patient has myelokyphosis, which occurs in some patients with a thoracic level of spina bifida. The myelokyphosis is caused by a lack of posterior spinal osteoligamentous elements and denervated musculature and has a sharp, single apex with a compensatory lordosis above and below the apex. Myelokyphosis is steadily progressive with growth. Bracing and casting are ineffective treatments for patients with myelokyphosis due to the focality of the complication and insufficient skin coverage over the apex. Posterior fusion in situ is mechanically ineffective in controlling the large focal curve occurring in myelokyphosis. Anterior strut grafting in a growing child functions as an anterior bar that exacerbates the patientâs myelokyphosis. A kyphectomy is the best treatment for a patient with myelokyphosis. A kyphectomy entails a posterior resection of the apical vertebra and posterior instrumentation. Posterior instrumentation corrects the cantilever. A kyphectomy does not entail fusion beyond the resected area because such a fusion impedes growth.Correct Answer: Posterior vertebral excision and instrumentation

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2238. (2877) Q5-3378:

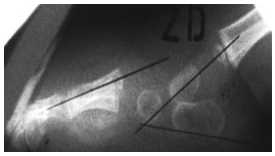
Slide 1

This is a radiograph (Slide) of a patient with myelomeningocele. At which of the following levels is the lesion located:

1) L1
3) L4
2) L2
5) S1
4) L5

This patient has active quadriceps (which are innervated through L2-L4) and adductors (which are innervated through L1-L3). Because the patientâs knees are slightly hyperextended there is no hamstring function. The patientâs right foot has some dorsiflexion. The lesion is rated as L4. However, the patientâs right side may be rated as L3.Correct Answer: L4

2239. (2878) Q5-3379:



Slide 1 **Slide 2**

A 1-year-old patient with L4 myelomeningocele presents with a foot complication. Radiographs are shown in neutral plantarflexion (Slide 1) and in maximal plantarflexion (Slide 2). Recommended treatment includes:

1) Ponsetiâs cast treatment
3) Complete subtalar release
2) Orthotic treatment
5) Excision of midtarsal bone
4) Open reduction of congenital talonavicular dislocation

This patient has a congenital vertical talus, also known as a congenital dorsolateral dislocation of the talonavicular joint. Because the navicular is not yet ossified, the dorsal position of the first metatarsal line illustrates evidence of the patientâs congenital vertical talus when compared to the position of the talus. The congenital vertical talus is fixed because it does not become reduced upon maximum plantarflexion. The best treatment for congenital vertical talus is open reduction of the congenital talonavicular dislocation, with tendon lengthening.Correct Answer: Open reduction of congenital talonavicular dislocation

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2240. (2879) Q5-3380:

Slide 1

An 8-year-old girl with myelomeningocele has sustained warmth and swelling of her leg for 2 weeks. She does not recall any trauma. She has had a temperature of 101Â° on several occasions. Her radiograph (Slide) is shown below. The most likely diagnosis is:

1) Osteomyelitis of the tibia
3) Deep venous thrombosis
2) Fracture of the distal tibia
5) Osteogenic sarcoma
4) Ewingâs tumor

This patient has a Salter 1 physeal fracture of the distal tibia, which was probably caused by stress that remained unrecognized due to the patientâs lack of pain. Patients with spina bifida experience extensive periosteal reaction because they do not get early immobilization.Correct Answer: Fracture of the distal tibia

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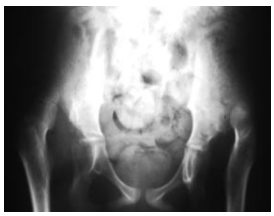
2241. (2880) Q5-3381:



Slide 1

This radiograph (Slide) shows a 5-year-old boy with an L4 myelomeningocele. He can ambulate with a walker. Recommended treatment includes:

1) Observation
3) Bilateral adductor tenotomy
2) Abduction bracing
5) Bilateral adductor tenotomy, femoral and iliac osteotomy
4) Bilateral adductor tenotomy and femoral osteotomy

This patient has symmetrical high, longstanding dislocations. Because his level is L4, he has no abductor function. The patient has multiple contraindications to surgery, including current symmetry, lack of abduction power, young age, and an inability to walk without a walker. His ability to walk would likely be hindered by surgery.Correct Answer: Observation

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2242. (2881) Q5-3382:

Slide 1 **Slide 2**

The first radiograph (Slide 1) shows the pelvis of a patient with L3 myelomeningocele at 9 years old. The second radiograph (Slide 2) shows the pelvis of the same patient taken 2 years later. Which of the following factors most likely contributed to the change in the patientâs pelvis:

1) Increased standing activity in therapy
3) Adductor tenotomy
2) Excessive sitting
5) Tethered cord
4) Chiariâs malformation

Note that the radiograph in Slide 1 shows normal hip joints, and the radiograph in Slide 2, which was taken 2 years later, shows symmetric dislocation.

This patient has a tethered cord. The tethered cord caused increased spasticity, resulting in the spontaneous dislocation of the patient's hips during the 2 years between the time the two radiographs were taken.

Correct Answer: Tethered cord

2243. (2882) Q5-3383:

In which of the following molecules is McCune-Albrightâs syndrome due to a mutation:

1) Fibroblast growth factor receptor protein
3) Bone morphogenetic protein
2) GNAS1
5) Collagen type 1
4) Fibrillin

McCune-Albrightâs syndrome (also known as polyostotic fibrous dysplasia) is due to a mutation in GNAS1. GNAS1 is the alpha subunit of GS, which is a protein that links receptors to adenyl cyclase activity.Correct Answer: GNAS1

2244. (2883) Q5-3384:

Which of the following symptoms is not characteristic of McCune-Albrightâs syndrome:

1) CafÃ©-au-lait spots with irregular borders
3) Precocious puberty
2) CafÃ©-au-lait spots with smooth borders
5) Hyperthyroidism
4) Diabetes mellitus

The cafÃ©-au-lait spots associated with McCune-Albrightâs syndrome are described as âcoast of Maineâ spots because they have irregular borders. The cafÃ©-au-lait spots associated with neurofibromatosis are described as âcoast of Californiaâ spots because they have smooth borders.Correct Answer: CafÃ©-au-lait spots with smooth borders

---

2245. (2884) Q5-3385:

A 12-year-old patient with fibrous dysplasia has an increasing limp and progressive bowing in the intertrochanteric and subtrochanteric regions of his femur. Recommended treatment includes:

1) Allograft strut graft in situ
3) Rod fixation in situ
2) Plate fixation in situ
5) Hip arthrodesis in straight position
4) Valgus osteotomy with plate and/or rod

The most important step in treating patients with fibrous dysplasia is to decrease the bending force on the patientâs femur. A valgus osteotomy with a plate or a rod decreases the bending force on the patientâs femur by decreasing the offset from the center of the patientâs body mass. Allografting and plate or rod fixation in situ causes progressive bowing in the patient.Correct Answer: Valgus osteotomy with plate and/or rod

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2246. (2885) Q5-3386:

Which of the following bones is the most common site for involvement with fibrous dysplasia:

1) Phalanges of the hand
3) Ulna
2) Radius
5) Femur
4) Humerus

The femur and the tibia are the most common sites of fibrous dysplasia in the appendicular skeleton. Involvement of the humerus is also common. Fibrous dysplasia may also occur in the radius, ulna, and phalanges of the hand; it occurs less frequently in the femur, humerus, and pelvis.Correct Answer: Femur

---

2247. (2886) Q5-3387:

What is the risk of malignant transformation over the course of a lifetime in a person with fibrous dysplasia:

1) 50%
3) 15%
2) 25%
5) Less than 1%
4) 5%

Fibrous dysplasia is a relatively common disorder. The risk of malignant transformation is less than 1%. Many historic cases of malignant transformation with fibrous dysplasia occurred in patients who also received external beam irradiation.Correct Answer: Less than 1%

2248. (2887) Q5-3388:

The most common malignancy arising from transformation of fibrous dysplasia is:

1) Chondrosarcoma
3) Giant cell tumor
2) Adamantinoma
5) Fibrosarcoma
4) Osteosarcoma

The most common malignancies arising from transformation of fibrous dysplasia are osteosarcoma and malignant fibrous histiocytoma. However, chondrosarcoma, giant cell tumor, adamantinoma, and fibrosarcoma have been reported to result from fibrous dysplasia. Radiation increases the risk of malignant transformation of fibrous dysplasia.Correct Answer: Osteosarcoma

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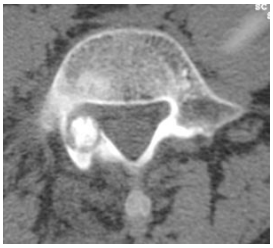
2249. (2888) Q5-3389:

The pattern of genetic transmission of polyostotic fibrous dysplasia is best described as:

1) Autosomal dominant with high penetrance
3) Autosomal recessive
2) Autosomal dominant with low penetrance
5) No genetic transmission (sporadic)
4) Sex-linked dominant

Fibrous dysplasia is a sporadic condition. Although there are a few reports of parents and children having fibrous dysplasia, such reports are rare.Correct Answer: No genetic transmission (sporadic)

2250. (2889) Q5-3390:



Slide 1

Which of the following conditions does this computerizd tomography scan (Slide) most likely represent:

1) Brodieâs abscess
3) Fibrous dysplasia
2) Osteosarcoma
5) Enchondromas
4) Osteoid osteoma

This is an osteoid osteoma of the fourth lumbar vertebra in a patient who experienced night pain and relieved the pain with nonsteroidal anti-inflammatory drugs. The location of a sclerotic nidus in the posterior elements of the vertebrae is typical for this disorder. Excision of the osteoid osteoma resulted in prompt pain relief for this patient.Correct Answer: Osteoid osteoma

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2251. (2890) Q5-3391:

Slide 1

This radiograph (Slide) shows a 9-year-old boy with scoliosis. From which of the following conditions is the boyâs scoliosis likely to have resulted:

1) Marfanâs syndrome
3) Neurofibromatosis
2) Osteogenesis imperfecta
5) Juvenile idiopathic scoliosis
4) Fibrous dysplasia

The patientâs scoliosis is the result of neurofibromatosis. A sharp focal curve over few vertebrae, thinning of apical pedicles, and spindling of the ribs are symptoms of neurofibromatosis that are indicated in the radiograph.Correct Answer: Neurofibromatosis

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2252. (3365) Q5-4273:

slide 1

A 5-year-old boy presents for examination. He is diagnosed with developmental dysplasia of the hip. Recommended treatment includes:

1) Closed reduction and cast application
3) Femoral osteotomy and closed reduction
2) Traction, closed reduction, and cast
5) Open reduction, femoral osteotomy, and iliac osteotomy
4) Open reduction and iliac osteotomy

At age 5, traction or closed reduction is not likely to produce a stable joint. Femoral shortening is indicated to reduce pressure, reducing the likelihood of avascular necrosis or redislocation. The most likely option to produce a stable joint is open reduction with femoral and iliac osteotomy.Correct Answer: Open reduction, femoral osteotomy, and iliac osteotomy

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2253. (3383) Q5-4298:

slide 1

The radiograph (Slide) of a 16-month-old toddler is presented. Which diagnosis is most appropriate:

1) Proximal focal femoral deficiency
3) Traumatic hip dislocation
2) Congenital coxa valga
5) Femoral retroversion
4) Developmental dysplasia of the hip

This patient has developmental dysplasia of the hip. The femoral head is delayed in ossifying because of lower contact pressure and the femur is anteverted, not retroverted.Correct Answer: Developmental dysplasia of the hip

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2254. (3384) Q5-4299:

slide 1 **slide 2**

A 4-year-old girl sustains an injury in a motor vehicle accident. She sustained a femoral artery injury, which was repaired. Her pubic diastasis is 4.5 cm. A radiograph (Slide 1) and clinical photograph (Slide 2) are presented. Which of the following treatment options is recommended:

1) Accept deformity; no weight bearing for 6 to 8 weeks
3) Long leg cast application
2) Spica cast application
5) Open reduction internal fixation
4) Pelvic sling

This is an open-book injury due to direct frontal impact, which presumably also injured the femoral artery directly. A pubic diastasis .2.5 cm should be reduced. Open reduction and internal fixation is the preferred method to accomplish this, using either a wire or a plate. External fixation is also an acceptable option. Casts and sling are more likely to cause pressure sores or to be ineffective.Correct Answer: Open reduction internal fixation

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2255. (3385) Q5-4300:

Loeys-Dietz syndrome is caused by a mutation in:

1) Fibrillin -1
3) TGF-beta receptor
2) Fibrillin-2
5) Decorin
4) Collagen type III

Loeys-Dietz syndrome is an autosomal dominant syndrome characterized by arterial tortuosity, aneurysms, hypertelorism, and bifid uvula or cleft palate. Scoliosis, foot deformities, ligamentous laxity, and other findings are often present. The aneurysms have particular risk for rupture at small diameters. This disorder is caused by mutations in genes encoding TGF-beta receptor 1 and 2.Correct Answer: TGF-beta receptor

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2256. (3386) Q5-4301:

An 11-year-old female patient with bilateral cavus feet presents with foot pain and callosities on the plantar surface of the foot. She is diagnosed with Charcot-Marie-Tooth disease and may require surgical intervention. During a standing Colemanâs lateral block test, the patientâs hindfoot varus corrects bilaterally when standing on a 1-inch wooden block. Which of the following surgical options is the most appropriate:

1) Plantar fasciotomy
3) Osteotomy of the first metatarsal
2) Plantar-based opening wedge osteotomy of the medial cuneiform
5) Triple arthrodesis
4) Lateral closing wedge osteotomy of the calcaneus

This patient has a typical cavovarus foot. The key in evaluating the treatment options is the standing block test. Because her hindfoot varus is corrected during this test, her hindfoot is flexible and a calcaneal osteotomy is not necessary. Osteotomy of the base of the first metatarsal is also not preferred in such a case because the growth plate becomes at risk for arrest, the procedure requires internal fixation, the second metatarsal head becomes at risk for a stress transfer lesion, and is not located at the side of the deformity. In Charcot-Marie-Tooth disease, the deformity apex generally lies in the tarsometatarsal articulations and the medial cuneiform.Correct Answer: Plantar-based opening wedge osteotomy of the medial cuneiform

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2257. (3387) Q5-4302:

Which of the following disorders is not a cause of cavus foot:

1) Charcot-Marie-Tooth disease
3) Myelomeningocele
2) Friedreichâs ataxia
5) Tarsal coalition
4) Poliomyelitis

All of the disorders mentioned may cause cavus foot except for tarsal coalition.Correct Answer: Tarsal coalition

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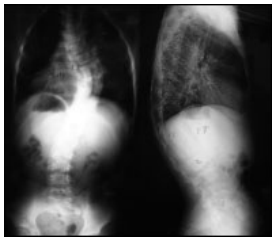
2258. (3388) Q5-4303:



slide 1 **slide 2**

Based on the clinical photograph (Slide 1) and radiographs (Slide 2) of this 11-year-old boy, which of the following conditions is demonstrated:

1) Idiopathic scoliosis
3) Tuberous sclerosis
2) Fibrous dysplasia
5) Diastematomyelia
4) Neurofibromatosis 1

This patient has many typical features of neurofibromatosis 1: subcutaneous neurofibromas, large âcoast of Californiaâ cafe-au-lait spot with several others, and a dystrophic curve at a young age. Surgery is recommended.Correct Answer: Neurofibromatosis 1

2259. (3389) Q5-4304:

Which of the following factors predicts an increased risk that a child sustaining a pelvis fracture will incur an unstable fracture:

1) Whether the triradiate cartilages are open or closed
3) Childâs body mass index
2) Childâs body weight
5) Presence of associated injuries
4) Childâs age

The closure of the triradiate cartilage of the acetabulum is associated with a significant increase in the risk of an unstable pelvis fracture, as well as the need for surgical treatment. This seems to signal the change in bone plasticity from pediatric type to adult type.Correct Answer: Whether the triradiate cartilages are open or closed

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2260. (3390) Q5-4305:

The mean age of triradiate cartilage closure in girls and boys is:

1) 10 years for girls and 12 years for boys
3) 12 years for girls and 13 years for boys
2) 11 years for girls and 12 years for boys
5) 13.5 years for girls and 14.5 years for boys
4) 12.5 years for girls and 13.5 years for boys

The triradiate cartilage closes at a mean of 12.5 years in girls and 13.5 years in boys. The closure of the triradiate cartilage signals the end of the peak height velocity (growth spurt). This is important for timing of scoliosis treatment and for signaling a change in pelvic fracture patterns from pediatric to adult.Correct Answer: 12.5 years for girls and 13.5 years for boys

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2261. (3391) Q5-4306:

Children with unstable pelvis fractures have an increased risk of late pain and dysfunction if which of the following is present:

1) Triradiate cartilages are closed
3) Pelvic asymmetry >1.1 cm after reduction
2) Pelvic asymmetry >0.6 cm after reduction
5) Age is older than 8 years
4) A spica cast is used

Pediatric pelvis fractures are associated with an increased risk of late pain and dysfunction if the asymmetry after reduction is .1.1 cm.Correct Answer: Pelvic asymmetry >1.1 cm after reduction

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2262. (3392) Q5-4307:

Which of the following is true regarding ability to remodel after a displaced pediatric pelvic fracture:

1) The pelvis will remodel if the patient is younger than 11 years old.
3) The pelvis will remodel if triradiate cartilages are open.
2) The pelvis will remodel if the patient is younger than 8 years old.
5) No significant remodeling is seen at any age.
4) The pelvis will remodel if the patient is premenarchal.

In pediatric pelvic fractures healing with asymmetry, no significant remodeling is seen at any age.Correct Answer: No significant remodeling is seen at any age.

2263. (3393) Q5-4308:

According to the Delbet classification, a transphyseal fracture of the pediatric proximal femur is considered type:

1) I
3) III
2) II
5) V
4) IV

According to the Delbet classification:

- Type I: Transphyseal fracture
- Type II: Transcervical fracture
- Type III: Basicervical fracture
- Type IV: Intertrochanteric fracture

Correct Answer: I

2264. (3394) Q5-4309:

According to the Delbet classification, the risk of avascular necrosis is least with which of the following pediatric hip fractures:

1) Type I
3) Type III
2) Type II
5) Type V
4) Type IV

The risk of avascular necrosis is highest with type I, followed by about equal rates for types II and III (approximately 15 %). The risk of avascular necrosis is low for type IV, intertrochanteric fractures.

Type I Transphyseal
Type II Transcervical
Type III Basicervical
Type IV Intertrochanteric

Correct Answer: Type IV

2265. (3395) Q5-4310:

A 14-year-old boy sustains a hip dislocation in a motor vehicle accident. Recommended treatment is:

1) Closed reduction using skeletal traction
3) Open reduction through a posterior approach
2) Closed reduction using fluoroscopy
5) Percutaneous physeal stabilization followed by closed reduction
4) Open reduction through an open approach

Hip dislocations in young adolescents require a high-energy trauma, which may result in occult injury to the physis. Numerous reports of physeal separation during the reduction are found in the literature. The authors of the largest series recommend gentle closed reduction under fluoroscopy followed by prophylactic stabilization if there is evidence of physeal injury.Correct Answer: Closed reduction using fluoroscopy

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2266. (3396) Q5-4311:

Which of the following has not shown a decrease in the success rate of flexible intramedullary nails for femur fractures in children:

1) Age older than 10 years
3) Comminution
2) Weight more than 120 lbs
5) Transverse fracture pattern
4) Long oblique fracture pattern

All of the factors, except for a transverse fracture pattern, have been shown to decrease the chances of success in treating children with femur fractures using flexible intramedullary nails.Correct Answer: Transverse fracture pattern

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2267. (3397) Q5-4312:

Which of the following is the best starting point for inserting a rigid femoral intramedullary nail in a 13-year-old boy:

1) Piriformis fossa
3) Apex of the greater trochanter
2) Medial to the tip of the greater trochanter
5) Below the growth plate of the greater trochanter
4) Between the tip and the growth plate of the greater trochanter

Avascular necrosis is a risk if a nail is inserted near the piriformis fossa in a patient younger than 15 years old with open physes. The best way to avoid this risk is to insert the intramedullary nail just lateral to the tip of the greater trochanter.Correct Answer: Between the tip and the growth plate of the greater trochanter

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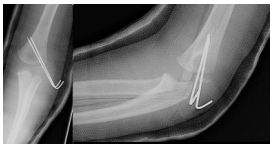
2268. (3398) Q5-4313:



slide 1

A patient had an elbow fracture that was openly reduced and internally fixed. The radiographs (Slide) from his first postoperative checkup are presented. Which of the following is a correct assessment:

1) The fixation is adequate.
3) The two pins should have diverged in the proximal fragment.
2) The second pin should have been placed from the medial side.
5) The pins should have been buried under the skin.
4) The pins should have been larger in diameter.

This patient has a lateral condyle fracture. This type of fracture has a tendency to spread unless adequate compression is maintained. Diverging pins in the proximal fragment is the most widely advocated strategy.Correct Answer: The two pins should have diverged in the proximal fragment.

2269. (3399) Q5-4314:

Which of the following femur fractures is best treated with flexible intramedullary nails:

1) A 12-year-old child, 45 kg, transverse fracture of the midshaft
3) An 8-year-old child, 55 kg, transverse fracture of the midshaft
2) An 8-year-old child, 28 kg, midshaft fracture with grade 3 butterfly fragment
5) A 4-year-old child, 20 kg, transverse midshaft fracture with 2 cm shortening
4) An 8-year-old child, 35 kg, oblique fracture 8 cm below the lesser trochanter

Age older than 10 years, weight greater than 50 kg, and length-unstable fractures are associated with poor results after insertion of flexible intramedullary nails. The subtrochanteric region is defined in children as 10% femur length below the lesser trochanter. Children age 5 and younger are best treated with immediate spica cast.Correct Answer: An 8-year-old child, 35 kg, oblique fracture 8 cm below the lesser trochanter

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2270. (3400) Q5-4315:

A mutation in the gene for peripheral myelin protein 22 causes which of the following disorders:

1) Friedreich ataxia
3) Cerebral palsy
2) Charcot-Marie-Tooth disease
5) Fragile X syndrome
4) Adrenoleukodystrophy

Type I, or the hypertrophic demyelinating form, is the most common form of Charcot-Marie-Tooth disease. It is due to a mutation in the gene on chromosome 22, which encodes for peripheral myelin protein 22. Type I Charcot-Marie-Tooth disease has a prevalence of approximately 1 in 5,000 individuals.Correct Answer: Charcot-Marie-Tooth disease

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2271. (3401) Q5-4316:

Which of the following statements is true of scoliosis in patients with Charcot-Marie-Tooth disease:

1) Scoliosis responds well to bracing.
3) Scoliosis is rarely progressive.
2) Spinal cord monitoring is usually normal.
5) Thoracic kyphosis is less than in idiopathic scoliosis.
4) Thoracic curves more commonly have an apex convex to the left than the right.

Scoliosis is more common in patients with Charcot-Marie-Tooth disease than in the general population (between 10% to 33%). Only 15% of curves are halted by bracing. Scoliosis is commonly associated with thoracic kyphosis and with a left thoracic curve pattern. Intraoperative spinal cord monitoring is often difficult to elicit even at baseline due to the underlying neurologic disorder.Correct Answer: Thoracic curves more commonly have an apex convex to the left than the right.

2272. (3402) Q5-4317:

Risk factors for developmental dysplasia of the hip (DDH) include all of the following except:

1) Oligohydramnios
3) Congenital muscular torticollis
2) Firstborn child
5) Male gender
4) Identical twin with DDH

Developmental dysplasia of the hip is caused by both genetic and mechanical factors. Crowding and laxity are common factors. Females, pregnancies with oligohydramnios, firstborn children, infants with congenital muscular torticollis, and those with an affected identical twin are at increased risk. Also parental hip dysplasia, congenital dislocation of the knee, and breech position increase the risk of DDH.Correct Answer: Male gender

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2273. (3403) Q5-4318:

In ultrasound of the infant hip, the alpha angle is defined as:

1) The angle between the acetabular roof and the midline of the pelvis
3) The angle between the center of the femoral head and the lateral wall of the ilium
2) The acute angle between the lateral wall of the ilium and the extension of the acetabular roof
5) The angle between the acetabular roof and the transverse plane
4) The angle of the thigh required to produce subluxation of the hip on the sonogram

The alpha angle is the acute angle between the lateral wall of the ilium and the extension of the acetabular roof. This angle varies inversely with the acetabular index as seen on plain radiographs.Correct Answer: The acute angle between the lateral wall of the ilium and the extension of the acetabular roof

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2274. (3404) Q5-4319:

In a sonogram, the normal alpha angle of the neonatal hip measures:

1) <50Â°
3) <30Â°
2) <40Â°
5) >75Â°
4) >50Â°

The alpha angle is the acute angle formed by the lateral wall of the ilium and the extension of the acetabular roof. This angle varies inversely with the acetabular index as seen on plain radiographs. An angle >50Â° is normal.Correct Answer: >50Â°

2275. (3405) Q5-4320:

Diagnosis of Duchenne muscular dystrophy in a female patient could be explained if the patient had which of the following:

1) Addison disease
3) Trisomy 21
2) Turner syndrome
5) Fragile X syndrome
4) Klinefelter syndrome

Duchenne muscular dystrophy is the most common form of muscular dystrophy, affecting one in 3,300 males. Duchenne muscular dystrophy is an X-linked recessive defect that results from the absence of dystrophin. It may be expressed in females with Turner syndrome, which is the presence of a single X chromosome. Such patients would otherwise be carriers of Duchenne muscular dystrophy but express this recessive disorder because they only have one X chromosome. Duchenne muscular dystrophy would not occur in Klinefelter syndrome, which involves the presence of an extra X chromosome, or in trisomy 21. Steroids can help mitigate the phenotype; therefore Addison disease (hypercortisonism) would not produce the disorder. Fragile X is the most common form of inherited mental retardation but affects only males.Correct Answer: Turner syndrome

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2276. (3406) Q5-4321:

Spinal muscular atrophy is due to a mutation in the gene for which of the following proteins:

1) Dystrophin
3) Peripheral myelin protein 22
2) Survival motor neuron
5) Type I collagen
4) Frataxin

Spinal muscular atrophy is due to a mutation in the survival motor neuron gene, which results in loss of many anterior horn cells of the spinal cord. Dystrophin abnormalities cause Duchenne and Becker dystrophies. Peripheral myelin protein 22 is disordered in Charcot-Marie-Tooth disease and frataxin in Friedreich ataxia. Type I collagen disorders cause structural skeletal dysplasias.Correct Answer: Survival motor neuron

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2277. (3407) Q5-4322:

Which of the following agents is contraindicated in children with open physes:

1) Pamidronate
3) Etidronate
2) Alendronate
5) Calcium carbonate
4) Teriparatide

Teriparatide, or Forteo (Eli Lilly and Company, Indianapolis, Ind), is contraindicated in children with open physes because of a concern for the risk of osteosarcoma.Correct Answer: Teriparatide

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2278. (3408) Q5-4323:

slide 1

A 15-month-old toddler, who is neurologically intact, presents with a fracture (Slide). Which of the following is the recommended treatment:

1) Posterior C1-C2 fusion
3) Open reduction and screw fixation
2) Posterior occiput-C2 fusion
5) Reduction and halo vest immobilization
4) C2 corpectomy and C1-C3 fusion anteriorly

This odontoid physeal fracture should be treated by postural reduction and external immobilization. The reduction maneuver is posterior translation with slight axial traction, which may be accomplished by a halter or a halo vest. Immobilization must include a device such as a Minerva cast or a halo vest that can control the head well.Correct Answer: Reduction and halo vest immobilization

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2279. (3409) Q5-4324:

slide 1

A 17-month-old toddler sustained a femur fracture (Slide) in a fall from a height. Which of the following is the best treatment method:

1) Pavlik harness
3) Femoral skeletal traction
2) Spica cast
5) Flexible intramedullary nails
4) External fixation

This toddlerâs fracture shows minimal shortening. Spica cast treatment is ideal for fractures of the femur in children younger than school age because of their portability, overgrowth, remodeling, and lack of implant to remove. A Pavlik harness does not control a child beyond the age of a few months. Femoral skeletal traction, external fixation, and flexible intramedullary nails are more invasive than is warranted.Correct Answer: Spica cast

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2280. (3410) Q5-4325:

slide 1

The lesion shown in the radiograph (Slide 1) most likely represents which of the following processes:

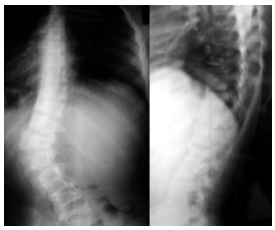
1) Aneurysmal bone cyst
3) Unicameral bone cyst
2) Fibrous dysplasia
5) Fibrous cortical defect
4) Osteomyelitis

The lesion shown in the radiograph is a unicameral bone cyst. The diagnosis was confirmed by aspiration and the subsequent response, filling in after autogenous marrow (Slide 2).

An aneurysmal bone cyst is typically more septated and expansile in width, fibrous dysplasia has a more blurred zone of transition and ground-glass appearance, and a fibrous cortical defect is more eccentrically placed.

Correct Answer: Unicameral bone cyst

2281. (3411) Q5-4326:



slide 1 **slide 2**

A clinical photograph (Slide 1) and radiographs (Slide 2) of a 13-year-old girl, who is neurologically normal, are presented. She does not report any pain. The most likely diagnosis is:

1) Fibrous dysplasia
3) Idiopathic scoliosis
2) Blue-rubber bleb nevus syndrome
5) Klippel-Trenaunay syndrome
4) Neurofibromatosis-1

This patient has neurofibromatosis-1. She has a dystrophic scoliosis that is sharply angulated and involves only four vertebrae (Cobb levels T12-L3). The pedicles are thinned, and the endplates are scalloped. She also has subcutaneous neurofibromas.Correct Answer: Neurofibromatosis-1

2282. (3412) Q5-4327:

slide 1

An 11-year-old girl presents with a limp. She has no history of trauma, infection, or neurologic disorder. She does not report any pain. Recommended treatment includes:

1) Hip arthrodesis
3) Cemented total hip arthroplasty
2) Uncemented total hip arthroplasty
5) No treatment
4) Resurfacing hip arthroplasty

This patient has untreated developmental dysplasia of the hip. Her limp cannot be eliminated. If she is not experiencing pain, then no treatment is indicated.Correct Answer: No treatment

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2283. (3413) Q5-4328:

slide 1

The foot pictured in this clinical photograph (Slide) represents:

1) Calcaneovalgus foot
3) Calcaneus foot
2) Clubfoot
5) Skewfoot
4) Congenital vertical talus

The foot presented in the clinical photograph represents congenital vertical talus. Note the equinus of the hindfoot, calcaneus of the forefoot, and the crease in the sinus tarsi. In patients with a calcaneovalgus foot, the hindfoot is in calcaneus, not equinus.Correct Answer: Congenital vertical talus

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2284. (3414) Q5-4329:

Scapulothoracic fusion is most commonly indicated to help improve function in which of the following conditions:

1) Duchenne muscular dystrophy
3) Facioscapulohumeral dystrophy
2) Beckerâs muscular dystrophy
5) Congenital muscular dystrophy
4) Charcot-Marie-Tooth disorder

Facioscapulohumeral dystrophy is a rare disorder inherited in an autosomal dominant fashion. Thirty percent of affected individuals have a new mutation. The genetic abnormality is found on chromosome 4, with a decreased number of D4Z4 tandem repeats, but this does not appear to code for a protein product. In this condition, selective weakness of the serratus anterior, trapezius, and rhomboid muscles is present. Therefore, the scapula is not effectively stabilized against the trunk during use. Although the deltoid is relatively spared, it cannot work well due to a hypermobile scapula. Fusion of the scapula to the thorax improves range of abduction in this condition.Correct Answer: Facioscapulohumeral dystrophy

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2285. (3415) Q5-4330:

slide 1

A 15-year-old girl is experiencing progressive weakness. She is unable to abduct her arms above 100Â° (Slide). She has a progressive lordosis. Her facial expression is flat, and she cannot smile. Her mother has the same constellation of findings. No scoliosis is present. She and her mother are able to walk independently. The most likely diagnosis is:

1) Parsonage-Turner syndrome
3) Facioscapulohumeral dystrophy
2) Friedreich ataxia
5) Nemaline rod myopathy
4) Bellâs palsy

This patient most likely has facioscapulohumeral dystrophy. With a frequency of 1:20,000, it is a rare disorder inherited in an autosomal-dominant fashion. The genetic abnormality is found on chromosome 4, with a decreased number of D4Z4 tandem repeats, but this does not appear to code for a protein product. Scoliosis is not present. In this condition, selective weakness of the serratus anterior, trapezius, and rhomboid muscles is present. Therefore, the scapula is not effectively stabilized against the trunk during use.Correct Answer: Facioscapulohumeral dystrophy

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2286. (3416) Q5-4331:

slide 1

A 10-year-old child, who has no history of fever, trauma, or infection, presents with minimal pain and a Trendelenburg gait on the left (Slide). Which of the following is the most likely diagnosis:

1) Aneurysmal bone cyst
3) Fibrous dysplasia
2) Chronic osteomyelitis
5) Enchondroma
4) Unicameral bone cyst

This patient has fibrous dysplasia. The diffuse nature of the changes over a long portion of the bone, which includes blurring and thinning of the cortex, are classic signs of the disorder.Correct Answer: Fibrous dysplasia

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2287. (3417) Q5-4333:

A patient who does not walk outdoors or independently but can walk with a walker in physical therapy is listed as what level according to the Gross Motor Function Measure (GMFM):

1) Level 1
3) Level 3
2) Level 2
5) Level 5
4) Level 4

The GMF Classification System (GMFCS) is a concise way of expressing overall motor ability. According to this system, level 1 is walking and running indoors and out with impaired speed, level 2 is impairment in running on uneven surfaces, level 3 is ambulation indoors and out with assistive devices, and level 4 is limited walking with a walker, and level 5 is nonambulatory.Correct Answer: Level 4

2288. (3418) Q5-4334:

slide 1 **slide 2**

The patient shown in the clinical photograph (Slide 1) and radiograph (Slide 2) has which of the following conditions:

1) Klippel-Trenaunay-Weber syndrome
3) Proteus syndrome
2) Neurofibromatosis-1
5) Maffucci syndrome
4) Gorham disease

This patient has Klippel-Trenaunay-Weber syndrome. This syndrome is characterized by a triad of cutaneous nevi, varicose veins, and limb overgrowth in length and/or width.Correct Answer: Klippel-Trenaunay-Weber syndrome

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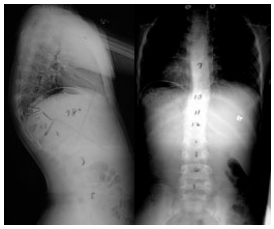
2289. (3419) Q5-4335:



slide 1 **slide 2**

An 8-year-old girl with no history of fever, illness, or weakness presents with an increasing spinal deformity. She was born in Asia. The patient is neurologically normal. Based on radiographs (Slide 1) and magnetic resonance images (Slide 2), the most likely diagnosis is:

1) Pyogenic spondylitis
3) Compression fractures
2) Tuberculous spondylitis
5) Scheuermann kyphosis
4) Congenital kyphosis

This patient has congenital kyphosis. The relative disk destruction with vertebral preservation argues against tuberculosis. The anterior bony wedging is atypical for remote bacterial infection. Anterior fusion is not seen in patients with Scheuermann kyphosis (rarely after maturity) or in patients with compression fractures.Correct Answer: Congenital kyphosis

---

2290. (3420) Q5-4336:

slide 1

An 8-year-old boy presents with progressive deformity. Recommended management includes:

1) Observation
3) Posterior fusion in situ
2) Bracing
5) Anterior and posterior fusion
4) Anterior fusion in situ

This patient has a type II kyphosis (anterior bar). Because he is only 8 years old and the curve has progressed, further increase is likely. Observation is not indicated. Bracing has no influence on congenital curves. The kyphosis is >55Â° (78Â°) so a posterior fusion may not effectively halt the growth of these vertebral bodies in a posterior direction. Anterior and posterior fusion is the most likely procedure to control the curve.Correct Answer: Anterior and posterior fusion

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2291. (3421) Q5-4337:

A child with congenital below-elbow amputation is best fit with an active prosthesis at which age:

1) 3 months
3) 9 months
2) 6 months
5) 24 months
4) 12 months

A patient with congenital below-elbow amputation has sensation/proprioception in the limb and is able to perform most activities without assistance. Prostheses may interfere with crawling. Passive devices should not be started until walking begins, and active devices started at 2 to 4 years.Correct Answer: 24 months

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2292. (3422) Q5-4338:

Which of the following is the most specific feature of congenital vertical talus that distinguishes it from other deformities:

1) Hindfoot equinus
3) Talonavicular dislocation
2) Forefoot adduction
5) Increased talonavicular angle
4) Peroneal tightness

The essential lesion in congenital vertical talus is a dorsolateral dislocation of the talonavicular joint.Correct Answer: Talonavicular dislocation

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2293. (3423) Q5-4339:

A 14-year-old boy sustains a hip dislocation in a motor vehicle accident. With closed reduction, he is at risk for all of the following except:

1) Physeal separation
3) Degenerative joint disease
2) Entrapped osteochondral fragment
5) Protrusio acetabulae
4) Avascular necrosis

With a hip dislocation in a young adolescent, occult injury to the physis may occur. Reports of physeal separation during the reduction, as well as entrapped osteochondral fragments appear in the literature. Degenerative joint disease may eventually develop due to the cartilage injury. Avascular necrosis risk is approximately 10%.Correct Answer: Protrusio acetabulae

---

2294. (3424) Q5-4340:

A 12-year-old boy sustains a distal diaphyseal femur fracture with a large butterfly fragment. He weighs 110 lb. Which of the following treatments is most appropriate and best able to preserve alignment:

1) Flexible intramedullary nails
3) Submuscular plate fixation
2) Immediate hip spica cast
5) Traction for 1 week followed by functional cast-brace
4) Retrograde nail

A large butterfly fragment as well as the age and weight of the patient have been demonstrated to decrease the chances of success in treating children with femur fractures using flexible intramedullary nails. For similar reasons, the fracture is not suitable for an immediate spica or traction followed by functional bracing. The retrograde nail is not indicated due to open physis. Submuscular plate fixation is the best option.Correct Answer: Submuscular plate fixation

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2295. (3425) Q5-4341:

Which of the following risks is associated with inserting a rigid femoral intramedullary nail through the piriformis fossa in a 10- to 14-year-old child:

1) Obligatory varus deformity at the fracture
3) Avascular necrosis
2) Trochanteric overgrowth
5) Recurvatum
4) Chondrolysis

Avascular necrosis is a risk if a nail is inserted through the piriformis fossa in a patient younger than 15 years of age with open physes.Correct Answer: Avascular necrosis

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2296. (3426) Q5-4342:

Which of the following is a description of a closed kinetic chain exercise:

1) The distal ends of a limb are against fixed resistance
3) The distal limb exerts force against an elastic chain
2) The distal ends of a limb are free to travel in space
5) Two limbs move together
4) The limb is suspended from a chain

A closed kinetic chain exercise is one in which the ends of a limb are fixed from free movement by resistance.Correct Answer: The distal ends of a limb are against fixed resistance

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2297. (3427) Q5-4343:

The action of bisphosphonates is primarily upon which component of bone:

1) Osteoclast
3) Cartilage
2) Osteoblasts
5) Nutrient vessel
4) Periosteum

Bisphosphonates act to inhibit osteoclasts, thereby decreasing resorption and increasing bone mineral density in many conditions.Correct Answer: Osteoclast

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2298. (3428) Q5-4344:

Which of the following is not a common finding in patients with Prader-Willi syndrome:

1) Short stature
3) Scoliosis
2) Developmental delay
5) Arachnodactyly
4) Osteopenia

Prader-Willi syndrome is characterized by early hypotonia, short stature, severe obesity, developmental delay, scoliosis, and osteopenia.Correct Answer: Arachnodactyly

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2299. (3429) Q5-4345:

slide 1

Which of the following disease processes is demonstrated in the radiograph (Slide):

1) Pigmented villonodular synovitis
3) Developmental dysplasia of the hip
2) Slipped capital femoral epiphysis
5) Multiple epiphyseal dysplasia
4) Legg-Calve-Perthes disease

The left femoral epiphysis shows avascular changes characteristic of Legg-Calve-Perthes disease without slippage. Although developmental dysplasia of the hip may also be complicated by avascular changes, the femoral neck and acetabulum would manifest more longstanding growth alterations as well. The contralateral hip would be symmetric in patients with multiple epiphyseal dysplasia.Correct Answer: Legg-Calve-Perthes disease

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2300. (3430) Q5-4346:

slide 1

Which of the following accurately describes this radiograph (Slide):

1) Catterall 2
3) Lateral pillar C
2) Catterall 3
5) Salter-Thompson A
4) Stulberg 3

According to Herringâs classification, this radiograph demonstrates a lateral pillar C because the lateral pillar is collapsed by more than 50%.Correct Answer: Lateral pillar C

2301. (3431) Q5-4347:

slide 1

An 11-year-old girl presents with bilateral painful flatfeet. A computed tomography image is shown (Slide). The most likely diagnosis is:

1) Idiopathic planovalgus feet
3) Degenerative joint disease
2) Talocalcaneal coalition
5) Osteochondritis dissecans
4) Osteoid osteoma

This patient has evolving medial talocalcaneal facet coalition. The computed tomography is remarkable for obliquity of the medial facet, along with irregularity and narrowing of this facet, which is not evident on plain radiographs. Normally the medial subtalar facet should be parallel to the posterior facet. Treatment options for this patient include immobilization, resection, or subtalar fusion.Correct Answer: Talocalcaneal coalition

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2302. (3455) Q5-4383:

Which of the following is not a common feature of constriction band syndrome:

1) Annular rings
3) Digital amputation
2) Fenestrated syndactyly
5) Hip dislocation
4) Equinovarus foot

Constriction band syndrome is not commonly associated with developmental dislocation of the hip. However, annular rings, fenestrated syndactyly, digital amputation, and equinovarus foot are often seen in patients with constriction band syndrome.Correct Answer: Hip dislocation

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2303. (3474) Q5-4412:

An 8-year-old child presents with a mass on the posteromedial side of the popliteal fossa. The mass, which has been present for more than 1 month, is nontender and moderately soft. The knee examination is stable. No knee effusion is present, and the patient has no signs or symptoms of infection. Radiographs are normal. Which of the following is the next step to aid in diagnosis:

1) Magnetic resonance imaging
3) Computed tomography
2) Bone scan
5) Biopsy
4) Transillumination

This patient demonstrates the classic presentation of a popliteal cyst. Transillumination often confirms the diagnosis of popliteal cyst, thereby avoiding the use of advanced imaging.Correct Answer: Transillumination

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2304. (3492) Q5-4434:

Which of the following features is not associated with congenital muscular torticollis:

1) Developmental dysplasia of the hip
3) Flattening of the occiput contralateral to the tight sternomastoid
2) Metatarsus adductus
5) Imperforate anus
4) Asymmetrical facial features

Congenital muscular torticollis is caused by in-utero molding, as are developmental dysplasia of the hip and metatarsus adductus. Contralateral occipital flattening and asymmetrical facial features develop secondarily with torticollis. Imperforate anus is associated with congenital hemivertebrae but not with muscular torticollis.Correct Answer: Imperforate anus

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2305. (3495) Q5-4437:

A 3-month-old female infant presents with the dorsum of the foot almost in contact with the anterior tibia. She has no pain with movement; plantar flexion and inversion of the feet are not restricted, but there is difficulty in manipulating the foot to the neutral position. She is normal otherwise. Which of the following treatments is most appropriate:

1) Observation Â± passive stretching
3) Botulinum toxin to peroneals
2) Serial casting
5) Surgical reduction
4) Serial casting and then surgery

This is a patient with positional calcaneovalgus, which is a more common condition than congenital vertical talus (CVT). Patients with such deformity should be evaluated carefully and differentiated from the more serious CVT. In calcaneovalgus foot, the problem is in the ankle, which is in calcaneus position. The arch itself may be normal. In CVT, the ankle is normal and the problem is in the foot. The foot is essentially plantigrade, but the arch is reversed. Typically, a deep crease in the sinus tarsi and some forefoot abduction are present.

No difference was found between the calcaneovalgus feet that underwent manipulation and casting versus observation alone, when assessed at 3 to 11 years of follow-up. Surgery is never required for a positional calcaneovalgus deformity, which is not true for CVT. Long-term prognosis of positional calcaneovalgus is excellent.

Correct Answer: Observation Â± passive stretching

2306. (3496) Q5-4439:

The best way to diagnose dysplasia epiphysealis hemimelica, in addition to history and physical, is:

1) Bone scan
3) Biopsy
2) Ultrasound
5) Bacterial culture
4) Plain radiograph

Dysplasia epiphysealis hemimelica, or Trevor disease, is an epiphyseal osteochondroma. The characteristic location, continuity with the epiphysis and alteration in growth of the epiphysis, is the most specific confirmation of the disease. Histology is less specific, as are bone scan and ultrasound.Correct Answer: Plain radiograph

2307. (3498) Q5-4443:

Which of the following commonly used statements regarding the pelvis in patients with bladder exstrophy is true:

1) The forces across the hip joints are increased in patients with bladder exstrophy.
3) Significant limp persists throughout life in patients with bladder exstrophy.
2) Athletic ability is significantly compromised in patients with bladder exstrophy.
5) Urinary continence is not possible in patients with bladder exstrophy.
4) The pelvis is more vulnerable to fracture in patients with bladder exstrophy.

In patients with bladder exstrophy, computerized modeling shows that the forces across the hip are increased by approximately 30%. However, limp is not significant and the pelvis is not more prone to fracture. Most patients can be made continent through surgery.Correct Answer: The forces across the hip joints are increased in patients with bladder exstrophy.

2308. (3512) Q5-4465:

A 1-year-old child requires evaluation of limb length inequality. The surgeon notices a disproportional increase in length, as well as width, of the ipsilateral upper and lower extremity. No other physical abnormalities are evident. Recommended treatment includes which of the following:

1) Ultrasound periodically throughout childhood
3) MRI of the affected extremities
2) Brain magnetic resonance imaging (MRI)
5) Angiogram of the affected limbs
4) Spinal ultrasound

Idiopathic hemihypertrophy is associated with an increased incidence of intra-abdominal tumors such as Wilmsâ tumor and hepatoblastoma. Periodic screening by ultrasound throughout childhood is recommended.Correct Answer: Ultrasound periodically throughout childhood

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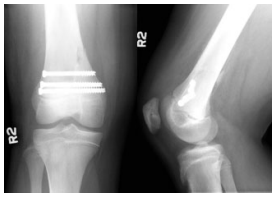
2309. (3571) Q5-4567:

Which of the following statements describes the growth plate biomechanics of the distal femur:

1) The collateral ligaments protect the distal femur.
3) The anterior cruciate ligaments protect the distal femur.
2) The posterior cruciate ligament protects the distal femur.
5) The distal femur is not protected by any ligaments.
4) The patellar ligament protects the distal femur.

Whereas the the proximal tibial physis is protected by the collateral ligaments and tibial tubercle epiphysis, the distal femoral physis is vulnerable to injury because it is not protected by any ligaments.Correct Answer: The distal femur is not protected by any ligaments.

2310. (3572) Q5-4568:



slide 1 **slide 2**

A 200-lb 13-year-old boy sustained a fracture while playing football. His radiographs are presented (Slide 1). Which of the following treatments should be attempted first:

1) Closed reduction and internal fixation
3) Open reduction and plate fixation
2) Open reduction and screw fixation
5) Arthroscopically assisted reduction and internal fixation
4) External fixation

The radiographs show a Salter II fracture with a large metaphyseal fragment. A high likelihood exists for successful closed reduction, and the metaphyseal fragment should allow rigid fixation. This patient received closed reduction and was internally fixed with three percutaneous 7.3-mm screws (Slide 2). He did not require a cast.Correct Answer: Closed reduction and internal fixation

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2311. (3573) Q5-4569:

An 8-year-old boy was injured by a lawnmower. The resulting proximal tibial injury presented in the radiograph (Slide) is classified as a:

1) Salter I injury
3) Salter III injury
2) Salter II injury
5) Salter V injury
4) Salter IV injury

A Salter IV injury to the proximal tibia is apparent in the patientâs radiograph. The fracture traverses the epiphysis, physis, and metaphysis medial to the tibial spine. No injury to the lateral portion of the plateau is present. Incidentally, the distal femoral injury is also classified as Salter IV.Correct Answer: Salter IV injury

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2312. (3574) Q5-4570:

A 12-year-old boy twisted his knee while riding a bicycle. Based on his radiographs (Slide), which of the following is the most appropriate diagnosis:

1) Patellar dislocation
3) Tibial spine avulsion
2) Traumatic osteochondritis dissecans
5) Tibial tubercle fracture
4) Anterior cruciate ligament tear

This patient has a tibial spine avulsion, classified as type III by McKeever and Meyers. Treatment options include closed immobilization or arthroscopic or open reduction and internal fixation.Correct Answer: Tibial spine avulsion

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2313. (3575) Q5-4571:

What is the most common cause of intoeing in children with bilateral cerebral palsy:

1) Internal pelvic rotation
3) Increased tibial torsion
2) Internal hip rotation
5) Forefoot adduction
4) Hindfoot rotation

The most common cause of intoeing in children with bilateral spasticity is internal hip rotation. For children with hemiplegia, the most common cause of intoeing is tibial torsion. In some patients, several causes may coexist to cause the condition.Correct Answer: Internal hip rotation

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2314. (3576) Q5-4572:

Risk factors for superior mesenteric artery syndrome after adolescent idiopathic scoliosis surgery include all of the following except:

1) Decreased correction of thoracic curve with preoperative bending
3) Lenke lumbar modifier B or C
2) Body mass index (BMI) below the 25th percentile
5) Use of iliac crest bone graft
4) Staged surgical correction

Superior mesenteric artery syndrome occurs more often in patients with decreased BMI, larger and stiffer thoracic curves, lumbar apical translation of Lenke B or C, and two staged procedures.Correct Answer: Use of iliac crest bone graft

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2315. (3577) Q5-4573:

An 8-year-old girl fractures her right femur when starting a sprint. Based on her radiograph (Slide), which of the following is the most likely diagnosis:

1) Unicameral bone cyst
3) Osteogenic sarcoma
2) Aneurysmal bone cyst
5) Normal pre-existing bone
4) Fibrous dysplasia

This patient has signs of a pre-existing fibrous dysplasia lesion, including a central expansion of the subtrochanteric region with a âground-glassâ (not lucent) appearance. She was diagnosed with fibrous dysplasia.Correct Answer: Fibrous dysplasia

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2316. (3578) Q5-4574:

An 8-year old girl with fibrous dysplasia fractures her femur (Slide). Which of the following procedures is the best treatment option:

1) Femoral traction followed by spica cast
3) Allograft strut and spica cast
2) Curettage, bone graft, and spica cast
5) Hip screw with long side plate
4) External fixation

This lesion requires mechanical support because it is vulnerable to malunion and further deformity. Bone graft would be rapidly reabsorbed and has no lasting value in this patient. A screw with a long side plate that extends well into normal bone is the best treatment option.Correct Answer: Hip screw with long side plate

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2317. (3579) Q5-4575:

The patient presented in the radiograph (Slide) has a slight, painless limp. Which of the following is the most likely diagnosis:

1) Ollier disease
3) Fibrous dysplasia
2) Osteogenesis imperfecta
5) Fibrous cortical defects
4) Neurofibromatosis

This patient has multiple âground-glassâ lesions and one cystic lesion, as well as bowing in the subtrochanteric region. The patient was diagnosed with fibrous dysplasia.Correct Answer: Fibrous dysplasia

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2318. (3580) Q5-4576:

A 14-year-old boy sustains an avulsion of the tibial tubercle while playing basketball. The fracture extends vertically into the joint, crossing the proximal tibial articular surface. He is at greatest risk for which of the following complications:

1) Peroneal nerve injury
3) Popliteal artery disruption
2) Tibial nerve injury
5) Femoral nerve palsy
4) Anterior leg compartment syndrome

Fracture of the tibial tubercle has been reported to lead to compartment syndrome, presumably due to bleeding from the geniculate vessels and the exposed bone. This would not be expected from such a proximal fracture, but orthopedic surgeons should be aware of the possible association.Correct Answer: Anterior leg compartment syndrome

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2319. (3581) Q5-4577:

An infant presents with idiopathic scoliosis. Which of the following factors indicates observation as the treatment of choice:

1) Age younger than 1 year
3) Rib-vertebra phase 2
2) Rib-vertebral angle difference >20°
5) Left thoracic curve
4) Curve of 47°

Rib-vertebral angle difference >20° rib-vertebra phase 2, and curves >45° indicate a likely progression. The majority of infantile curves are left thoracic, so this is not a factor. A patient younger than 1 year of age has a higher chance of spontaneous resolution than an older patient. Therefore, absent other risk factors, observation is the initial recommend treatment.Correct Answer: Age younger than 1 year

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2320. (3582) Q5-4578:

Which of the following factors predicts a lesser degree of impairment of pulmonary function in patients with adolescent idiopathic scoliosis:

1) Increased Cobb angle
3) Increased cephalad apex of the curve
2) Decreased number of vertebrae in the curve
5) Pectus excavatum in addition to the scoliosis
4) Decreased thoracic kyphosis

An increased Cobb angle, increased cephalad apex of the curve, decreased thoracic kyphosis, and pectus excavatum in addition to the scoliosis are factors that predict a greater degree of pulmonary impairment. A lower number of vertebrae in the curve signals less impairment.Correct Answer: Decreased number of vertebrae in the curve

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2321. (3583) Q5-4579:

All except which of the following neurologic/muscular disorders can present undiagnosed in a patient with scoliosis:

1) Friedreichâs ataxia
3) Syringomyelia
2) Charcot-Marie-Tooth disease
5) Spinal cord tumor
4) Duchenne muscular dystrophy

Scoliosis can be caused by any neurologic disorder that affects trunk balance. Scoliosis is seen in most patients with Friedreichâs ataxia, a disorder in which patients present with an ataxic gait in preadolescence or adolescence. The curve becomes significant at about the same time as the ataxia. Scoliosis can also be seen in 10% of patients with Charcot-Marie-Tooth disease. This condition is characterized by cavus feet, intrinsic atrophy, and occasional hip dysplasia; no significant pain or clumsiness is present. Scoliosis is seen in many patients with syringomyelia. The syrinx and scoliosis both develop silently with no noticeable weakness until both the syrinx and the curve are significant. Spinal cord tumor may present with scoliosis in an ambulatory patient. Duchenne muscular dystrophy leads to scoliosis in most patients, but the patients become nonambulatory several years before the curve develops.Correct Answer: Duchenne muscular dystrophy

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2322. (3584) Q5-4580:

All except which of the following structural disorders often causes scoliosis and presents undiagnosed in patients:

1) Marfan syndrome
3) Osteogenesis imperfecta
2) Ehlers-Danlos syndrome
5) Achondroplasia
4) Loeys-Dietz syndrome

Although achondroplasia causes kyphosis, it is not associated with scoliosis to a significant degree. Marfan syndrome, Ehlers-Danlos syndrome, osteogenesis imperfecta, and Loeys-Dietz syndrome (a defect in TGF-beta receptor protein) are frequently associated with scoliosis.Correct Answer: Achondroplasia

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2323. (3585) Q5-4581:

Which of the following levels of evidence should be assigned to a prospective, randomized therapeutic study with 80% follow-up:

1) Level I
3) Level III
2) Level II
5) Level V
4) Level IV

A study may be level I as long as it has at least 80% follow-up.Correct Answer: Level I

2324. (3586) Q5-4582:

Which of the following levels of evidence should be assigned to a meta-analysis that covers all level I primary studies:

1) Level I
3) Level III
2) Level II
5) Level V
4) Level IV

A meta-analysis is considered level I evidence as long as all of the primary studies included in the meta-analysis are level I.Correct Answer: Level I

2325. (3587) Q5-4583:

A prospective comparative study should be assigned which level of evidence:

1) Level I
3) Level III
2) Level II
5) Level V
4) Level IV

A comparative study is one in which patients treated one way are compared with patients treated in another manner at the same institution. As long as the study is prospective, it can be assigned level II.Correct Answer: Level II

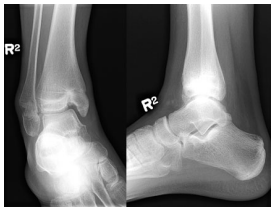
2326. (3588) Q5-4584:

A case-control study should be assigned which level of evidence:

1) Level I
3) Level III
2) Level II
5) Level V
4) Level IV

A case-control study is considered level III evidence, as is a retrospective comparison study or a meta-analysis in which the lowest level of primary study is level III.Correct Answer: Level III

2327. (3589) Q5-4585:



The radiographs (Slide) of a 13-year-old-boy are presented. The radiographs demonstrate characteristics of which of the following conditions:

1) Osteoid osteoma
3) Congenital dysplasia
2) Tibial hemimelia
5) Osteomyelitis
4) Fracture growth arrest

The radiographs show characteristics of a growth arrest from a medial distal tibial physeal fracture, either a Salter III or Salter IV. The fracture was not internally fixed, and the residual vertical fracture line and step-off are still visible. A growth plate bar developed and Park-Harris growth lines are seen on the lateral side of the bar. Some of the physis is open medially and, especially, laterally. The fibula has continued to grow.Correct Answer: Fracture growth arrest

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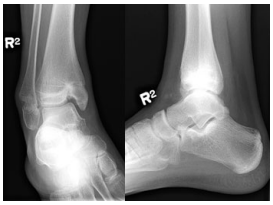
2328. (3590) Q5-4586:



An 11Â½ -year-old boy sustained a Salter IV fracture of the distal tibial physis. The fracture was treated in a cast. Two years later, his radiographs (Slide) are presented. The patient is starting to notice a deformity. Which of the following treatment plans is recommended:

1) Medial physeal bar resection
3) Right distal tibial and fibular epiphyseodesis
2) Right distal fibular epiphyseodesis
5) Right distal tibial and fibular osteotomy, and bilateral distal tibial and fibular epiphyseodesis
4) Left distal tibial and fibular epiphyseodesis

This patient has an unacceptable deformity, 2 cm of current shortening, and significant growth remaining. Only right distal tibial and fibular osteotomy, and bilateral distal tibial and fibular epiphyseodesis addresses all of the complications. Bar resection is not uniformly successful and would not correct existing deformity and length inequality, since there is minimal physis medial to the bar that could produce correction.Correct Answer: Right distal tibial and fibular osteotomy, and bilateral distal tibial and fibular epiphyseodesis

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2329. (3591) Q5-4587:

The radiographs (Slide) indicate which of the following diagnoses:

1) Congenital dysplasia of the distal humerus
3) Supracondylar humeral fracture
2) Osteogenesis imperfecta
5) Normal elbow
4) Lateral condylar humeral fracture

The radiographs indicate a supracondylar fracture of the distal humerus. The anterior humeral line should bisect the capitellum on the lateral view. The anterior and posterior fat pads are elevated. The fracture line may be seen on the anteroposterior and the lateral radiographs, although it is subtle. The cortical break of the coronoid fossa is evident. Surgeons must recognize these fractures so that the patient and family may be given proper activity restrictions and expectations for improvement.Correct Answer: Supracondylar humeral fracture

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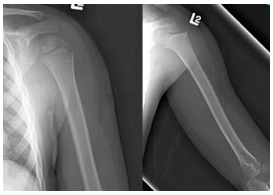
2330. (3592) Q5-4588:



A 5-year-old boy was imaged after being struck by a car. His radiographs (Slide) indicate which of the following diagnoses:

1) Buckle fracture of the proximal humeral metaphysis
3) Salter II fracture of the proximal humeral physis
2) Salter I fracture of the proximal humeral physis
5) Normal humerus
4) Salter IV fracture of the proximal humeral physis

The proximal humeral physis has two planes and two ossification centers (in this way, it is analogous to the proximal femur). When seen in some projections, the more distal extent of the physis may produce a lucent line. The smooth nature and characteristic location of the line should allow surgeons to make the correct interpretation. The two ossification centers of the humeral head may be misinterpreted as a fracture.

This patient had a greenstick fracture of the clavicle (not included on this field), which was not noticed, and a humeral fracture was incorrectly diagnosised.

Correct Answer: Normal humerus

2331. (3593) Q5-4589:

The largest available free muscle flap comes from which of the following muscles:

1) Gracilis muscle
3) Latissimus dorsi muscle
2) Serratus anterior muscle
5) Brachialis muscle
4) Rectus abdominis muscle

The latissimus dorsi provides the largest available free muscle flap. The gracilis provides a long muscle slip and can be innervated and used for certain innervated muscle transfers. The serratus anterior muscle is thin and can be used when bulk is undesirable.Correct Answer: Latissimus dorsi muscle

---

2332. (3594) Q5-4590:

slide 1 **slide 2** **slide 3**

A 12-year-old boy presents for evaluation of a spinal curvature (Slide 1). Which of the following is the most likely cause of the spinal curve:

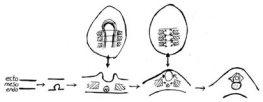
1) Idiopathic scoliosis
3) Osteoid osteoma
2) Neurofibromatosis
5) Cerebral palsy
4) Limb length inequality

This patient has a 2.5 cm shortening of the left lower extremity, which can be seen from the uneven pelvic height on the radiograph. The shortening produces a compensatory curve. No rotation is present within the curve. Scanogam (Slide 2) documents the inequality.

When the patient stands on a 2.5-cm lift, the curve is eliminated (Slide 3).

Correct Answer: Limb length inequality

2333. (3595) Q5-4591:



In the embryo, cells from the ectodermal layer give rise to which elements of the spine:

1) Spinal cord
3) Paraspinous muscle
2) Vertebral body
5) Annulus fibrosis
4) Nucleus pulposus

The spine is formed from all three elements of the embryonic plate (Slide). The ectoderm develops into a groove, folding into a tube that becomes the spinal cord. The endoderm gives rise to the notochord, which serves as the organizing structure for the spinal column. The notochord persists as the nucleus pulposus. The mesoderm gives rise to muscles and bony elements of the spinal column.Correct Answer: Spinal cord

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2334. (3596) Q5-4592:

How many somites are involved in formation of each vertebral body of the thoracolumbar spine:

1) None
3) Two
2) One
5) Four
4) Three

The somites are repeating groups of axial mesodermal cells that give rise to the osseous and musculoligamentous elements of the spine during embryonic formation. Each somite divides and contributes to two adjacent vertebral bodies.Correct Answer: Two

---

2335. (3597) Q5-6312:

A 6-year-old boy sustains a supracondylar fracture of the humerus. The 2 fragments are not completely displaced, but there is some overlap of the medial column and a gap on the lateral column of the distal humerus. Baumannâs angle measures 85Â°. The alignment on the lateral film shows no significant translation, but approximately 15Â° of increased extension. The recommended treatment is:

1) Accept this and treat in a long arm cast
3) Closed reduction with the elbow in extension to better monitor the angulation
2) Closed reduction with supination of the forearm and application of long arm cast
5) Open reduction and medial and lateral plate fixation
4) Closed reduction and percutaneous pin fixation

Closed reduction should allow regain of alignment and percutaneous pin fixation will allow it to be maintained.

- The elbow is in 10Â°-15Â° of varus and this will be an objectionable appearance in the future.
- Supination will increase the varus.
- Extension will exacerbate the deformity seen on the lateral and will cause further loss of contact of the fracture fragments.
- Medial and lateral plate fixation is needed in adolescents and adults with intercondylar fractures to allow early range of movement but is excessive treatment for this fracture in young children.

Correct Answer: Closed reduction and percutaneous pin fixation

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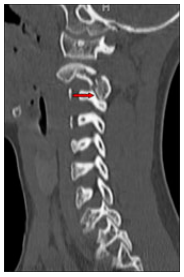
2336. (3603) Q5-6485:

slide 1



slide 2

The 7-year-old patient shown in this image (Slide 1) is most likely presenting with:

1) Atlas fracture
3) Facet subluxation
2) Spondylolysis of the axis
5) Fracture and subluxation
4) Fracture of C3

This patient has a spondylolisthesis of the axis, which is also known as a Hangmanâs fracture. Additionally, a subluxation of the C2-C3 facet is present on the right side. Such a subluxation often accompanies a Hangmanâs fracture. The comparison image (Slide 2) of the opposite facet is shown as a reference to demonstrate the normal alignment.Correct Answer: Fracture and subluxation

---

2337. (3604) Q5-6486:

slide 1 **slide 2**

Which of the following treatment options is recommended for the patient shown in the image (Slide 1, Slide 2):

1) Halo-vest immobilization
3) Soft cervical collar
2) Minerva cast immobilization
5) Atlantoaxial arthrodesis
4) Open reduction and internal fixation

Treatment must address the fracture of the C2 pars interarticularis and the C2-C3 facet subluxation. Options include traction to reduce the subluxation followed by external immobilization, or open reduction of the facet subluxation, which includes the opportunity to internally fix the fracture. Traction failed in this patient because the fracture eliminates a means to pull on the arch of C2. If facet subluxation is not present, then a cervicothoracic orthosis such as a Philadelphia collar is adequate for healing of the C2 spondylolysis.Correct Answer: Open reduction and internal fixation

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2338. (3605) Q5-6487:

Flexion-type supracondylar fractures of the distal humerus in children are characterized by which of the following when compared to extension-type injuries:

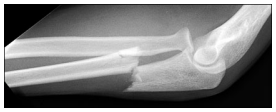
1) Younger age at presentation
3) Higher risk of anterior interosseous nerve injury
2) Higher risk of ulnar nerve injury
5) Greater frequency of occurrence
4) Lower risk of needing open reduction

Flexion-type supracondylar fractures of the distal humerus in children include the following characteristics:

- Frequency is less than one-tenth as that of extension-type supracondylar fractures
- Tend to occur in older children
- Lower risk of anterior interosseous nerve injury
- Higher risk of ulnar nerve injury
- More often require open reduction

Correct Answer: Higher risk of ulnar nerve injury

2339. (3606) Q5-6488:



slide 1 **slide 2** **slide 3**

The 12-year-old boy shown in the radiographs (Slide 1, Slide 2) sustained his injury during a motor vehicle accident. Which of the following most accurately describes the injury:

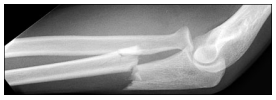
1) Oblique proximal ulna metaphyseal fracture
3) Type 1 Monteggia fracture
2) Oblique proximal ulna fracture and elbow dislocation
5) Maisonneuve fracture
4) Type I Galeazzi fracture

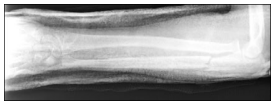
This patient has a proximal ulna fracture and an anterior dislocation of the radial head. The ulna-trochlea relationship is intact. On the lateral film, the radial head does not articulate with the capitellum. On the anteroposterior film, the radial head points to the capitellum, but the joint space is absent in contrast to that of the ulna-trochlear joint, which is normal. This injury is a type 1 (anterior) Monteggia fracture. The dislocation is clearly visible on Slide 3.

A Galeazzi fracture refers to a distal radioulnar dislocation with a radial fracture. A Maisonneuve fracture is a related concept in the lower extremity: a proximal fibular fracture with an ankle mortise injury.

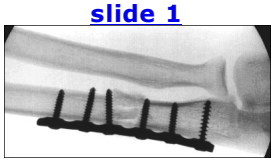
Correct Answer: Type 1 Monteggia fracture

2340. (3607) Q5-6489:





slide 1 **slide 2** **slide 3** **slide 4**



slide 5

A 12-year-old boy sustained the injury shown (Slide 1, Slide 2, and Slide 3). A postreduction film is also presented (Slide 4). Which of the following treatments is the most likely to produce satisfactory results:

1) Accept reduction and continue immobilization for 6 weeks
3) Increase elbow extension and reapply cast
2) Increase pronation of forearm and reapply cast
5) Stabilize radiocapitellar joint with pin
4) Plate fixation of ulna

This patient has a type 1 (anterior) Monteggia fracture. The radial head is not reduced in the splint. Although supination and flexion may stabilize the radius, the radius remained unstable in this patient because it was dislocated with only a slight offset of the ulna. Plate fixation of the ulna is more likely to stabilize the radius in a patient with this injury. After the ulna is fixed with a plate (Slide 5), the radial head cannot be dislocated. Radiocapitellar pinning should be used only as a final option because of the associated risks of stiffness and breakage.Correct Answer: Plate fixation of ulna

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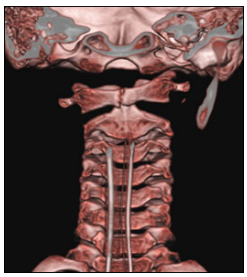
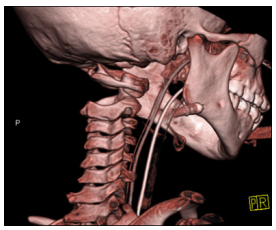
2341. (3608) Q5-6490:





slide 1 **slide 2** **slide 3**

A 7-year-old boy is intubated after being involved in a motor vehicle accident. His lateral cervical film (Slide 1) reveals a:

1) Normal study
3) Hangmanâs fracture
2) Jefferson fracture
5) Subaxial subluxation
4) Occiput-C2 subluxation

Extensive prevertebral soft tissue swelling is present. This patient received an injury that disrupted the ligaments of the atlanto-occipital and atlantoaxial joint. Additionally, he has a congenital synchondrosis of the C1 ring. The dens-basion distance (dens to the anterior rim of the foramen magnum) is 13 mm; the normal distance is less than 10 mm to 12 mm. The patient is pentaplegic. Three-dimensional computed tomography scans (Slide 2, Slide 3) are presented.Correct Answer: Occiput-C2 subluxation

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2342. (3609) Q5-6491:

slide 1 **slide 2**

The images presented (Slide 1, Slide 2) depict which process:

1) Spondylolisthesis
3) Aneurysmal bone cyst
2) Spondylolysis (pars defect)
5) Degenerative disk disease
4) Herniated nucleus pulposus

The images presented depict a pars interarticularis fracture of the third lumbar vertebra.Correct Answer: Spondylolysis (pars defect)

2343. (3610) Q5-6492:

Patients who have had a unilateral slipped capital femoral epiphysis (SCFE) are at what odds of a contralateral slip compared to the general population:

1) 2 times
3) 200 times
2) 20 times
5) 20,000 times
4) 2,000 times

Patients who have presented with a unilateral SCFE are at approximately 2,000 times the risk of a contralateral slip compared to the general population. The risk of a contralateral slip in a juvenile is approximately 1/10,000, which provides justification for prophylactic pinning of a second side if a surgeon thinks it is warranted.Correct Answer: 2,000 times

---

2344. (3611) Q5-6493:

slide 1 **slide 2**

Which of the following conditions is represented in the clinical photographs (Slide 1, Slide 2):

1) Ectrodactyly
3) Macrodactyly
2) Constriction band syndrome
5) Clubfoot
4) Microdactyly

This patient has ectrodactyly, which is a condition characterized by the central absence of rays. Ectrodactyly, also known as cleft foot or lobster-claw, may affect the upper or lower extremities. The incidence is rare (approximately 1/90,000 live births). The condition may result from a defect in the apical ectodermal ridge. Associated anomalies are not always present but may include cleft hand, deafness, tibial hemimelia, or urinary tract anomalies. Patients with ectrodactyly have nearly normal function, as long as the foot is not so wide as to prohibit normal shoe wear. If shoe wear is difficult, then the foot can be reconstructed using flaps to close the cleft and metatarsal osteotomies as indicated.Correct Answer: Ectrodactyly

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2345. (3612) Q5-6494:

slide 1 **slide 2**

A 6-year-old child is involved in a motor vehicle accident. What injury is demonstrated by the computed tomography (CT) (Slide 1) and magnetic resonance image (MRI) (Slide 2):

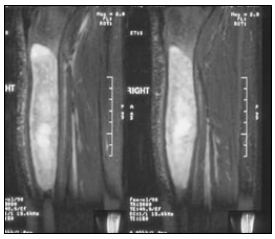
1) Jefferson fracture
3) Odontoid fracture
2) Transverse ligament injury
5) Pseudosubluxation
4) Hangmanâs fracture

This patient has an avulsion injury of the transverse ligament of the atlas. The bony avulsion is visible from its attachment to the left lateral mass and allows the atlas to move forward in relation to the axis. Hematoma and occiptocervical flexion is visible on the MRI. If it were an odontoid injury, the odontoid would still have a normal relationship to the ring of C1 on the CT.

Treatment involves reduction and fusion of C1-C2.

Correct Answer: Transverse ligament injury

2346. (3613) Q5-6495:



slide 1 **slide 2**

The radiograph (Slide 1) of an 11-year-old boy with significant leg pain is presented. No other abnormalities are found during the patientâs history or physical examination. The most likely diagnosis is:

1) Osteomyelitis
3) Enchondroma
2) Fibrous dysplasia
5) Ewing sarcoma
4) Unicameral bone cyst

Fibrous dysplasia is chronically expansile with vague transition to normal bone and a âground-glassâ appearance. These characteristics differentiate fibrous dysplasia from aneurysmal and unicameral bone cysts. Additionally, the lack of periosteal reaction differentiates fibrous dysplasia from malignancy or osteomyelitis. The patientâs magnetic resonance image (Slide 2) is also provided.Correct Answer: Fibrous dysplasia

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2347. (3614) Q5-6496:

slide 1 **slide 2**

The parents of a 12-year-old boy notice an abnormal shape on their sonâs forearm. He states that he does not feel any pain. Based on his radiograph (Slide), the most likely diagnosis is:

1) Congenital dislocation of the radial head
3) Osteogenesis imperfecta
2) Unrecognized traumatic dislocation of the radial head
5) Multiple exostoses
4) Fibrous dysplasia

This patient has multiple exostoses. Multiple exostoses, which result from a mutation on one of three EXT genes, cause a growth disturbance of affected limb segments. This effect is most pronounced in the two-bone segments (forearm and lower leg). The bone with the exostoses grows less in length and often develops angulation. The less-affected bone often develops secondary deformity, such as the radial head dislocation in this patient.

Fibrous dysplasia and osteogenesis imperfecta may lead to developmental dislocation of the radial head as well, but the associated bony changes allow correct diagnosis of each of these conditions.

Correct Answer: Multiple exostoses

2348. (3615) Q5-6497:

slide 1 **slide 2**

This 12-year-old patient presents with limited forearm movement, but he does not have any associated pain. Based on his radiograph (Slide), recommended treatment includes:

1) Open relocation of radial head with annular ligament reconstruction (Bell-Tawse procedure)
3) Ulnar lengthening and closed or open radial head reduction
2) Radial head excision
5) Observation
4) Creation of single-bone forearm

This patient has multiple exostoses. The deformities apparent on his radiograph are typical for this condition: ulnar shortening and bowing, radial head dislocation, increased distal radial articular slope and negative ulnar variance, and altered distal radioulnar joint anatomy. These deformities are not present at birth but develop with growth. Although many of the deformities associated with multiple exostoses lead to loss of forearm rotation, the deformities are often not painful. Little evidence suggests that reconstruction of the morphologic abnormalities improves function or prevents pain. Therefore, most experts recommend that surgery be undertaken only when a symptom, such as painful prominence of an exostosis or pain at the radial head after skeletal maturity, can be relieved. Exostoses are more likely to be followed by recurrence or stiffness if âkissing lesionsâ are present on the radius and ulna.Correct Answer: Observation

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2349. (3616) Q5-6498:

slide 1 **slide 2**

The 9-year-old patient presented in the radiographs (Slide 1, Slide 2) should be diagnosed with:

1) Congenital dislocation of the radial head
3) Osteogenesis imperfecta
2) Unrecognized traumatic dislocation of the radial head
5) Multiple exostoses
4) Fibrous dysplasia

This patient has type V osteogenesis imperfecta, which is characterized by hereditary radial head dislocation in 86% of patients (this patientâs mother and brother also have the condition bilaterally) as well as heterotopic calcification, osseous fragility, and scoliosis. Dislocation of the radial head occurs less often (0%-29%) in the other types of osteogenesis imperfecta and is linked to angular deformation of the long bones.

The signs of osteogenesis imperfecta in this patient include thin long bones, several healed fractures, and angular deformations.

Correct Answer: Osteogenesis imperfecta

2350. (3617) Q5-6499:

Which has a lower risk of compartment syndrome or delayed detection in a patient with a supracondylar fracture of the humerus:

1) Median nerve injury
3) Ipsilateral forearm fracture
2) Flexion greater than 110Â°
5) Flexion-type mechanism of the fracture
4) Ecchymosis or severe swelling

Median nerve injury increases the risk of delayed detection of the fracture because of the lack of sensation in the volar compartment and also increases risk of injury to the adjacent brachial artery. Flexion greater than 110Â° increases forearm pressures by compromising arterial inflow and venous return. An ipsilateral forearm fracture is associated with increased risk of compartment syndrome (7% with ipsilateral forearm fracture vs 0.3%without ipsilateral forearm fracture). Severe ecchymosis and swelling are also associated with an increased risk of compartment syndrome, even in the presence of a radial pulse. A flexion-type supracondylar fracture, by contrast, has a lower risk of compartment syndrome because of the lack of stretch or tension on the critical vascular structures.Correct Answer: Flexion-type mechanism of the fracture

---

2351. (3618) Q5-6500:

In a lateral radiograph of a childâs elbow, the anterior humeral line should be located:

1) Anterior to the capitellum
3) In the middle-third of the capitellum
2) In the anterior one-third of the capitellum
5) Posterior to the capitellum
4) In the posterior-third of the capitellum

In a childâs elbow, the anterior humeral line should be located in the middle-third of the capitellum.Correct Answer: In the middle-third of the capitellum

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2352. (3619) Q5-6501:

A 3-year-old boy falls on his upper extremity and shows sign of pain. His radiograph only shows a posterior fat pad sign of the elbow. What is the most likely diagnosis:

1) Nursemaid elbow
3) Supracondylar humerus fracture
2) Elbow sprain
5) Lateral condyle fracture
4) Proximal ulna fracture

A positive posterior fat pad sign is more suspicious for occult fracture than an anterior fat pad sign because flexing the elbow normally may elevate the anterior but not the posterior fat pad. A positive posterior fat pad sign is most likely to represent an undisplaced supracondylar fracture of the distal humerus, followed by proximal ulna, lateral conydle, and radial neck fracture. A nursemaid elbow is a diagnosis of exclusion and should be used only when the mechanism is one of traction rather than compression.Correct Answer: Supracondylar humerus fracture

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2353. (3620) Q5-6502:

Which of the following is not an indication to urgently treat a supracondylar humerus fracture:

1) Antecubital ecchymosis
3) Associated forearm fracture
2) Firm compartments
5) Medial comminution
4) Poor perfusion

Medial comminution is an indication of potential bony instability but does not convey any increased vascular risk. All of the other indications convey a vascular risk, and treatment should not be delayed.Correct Answer: Medial comminution

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2354. (3621) Q5-6503:

The lung attains half of its adult volume at what age:

1) 2 years
3) 6 years
2) 4 years
5) 10 years
4) 8 years

The lung attains 30% of its adult volume at 4 years and 50% at 8 years.Correct Answer: 8 years

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2355. (3622) Q5-6504:

Which of the following conditions is not associated with an increased risk of cavus foot:

1) Freidreich ataxia
3) Charcot-Marie-Tooth disease
2) Spina bifida
5) Calcaneonavicular coalition
4) Tethered cord

Calcaneonavicular coalition is typically associated with a planovalgus foot. Freidreich ataxia, spina bifida, Charcot-Marie-Tooth disease, and tethered cord are often associated with a cavus foot.Correct Answer: Calcaneonavicular coalition

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2356. (3623) Q5-6505:

Which of the following factors has not been proven to increase the risk of thermal necrosis to a limb with a cast:

1) Use of plaster
3) Folding a splint into double-thickness
2) Use of fiberglass
5) Using a dip water temperature more than 30Â°
4) Placing a recently casted limb on a pillow

Fiberglass is less likely than plaster to produce thermal injury, likely because of the increased porosity. All of the other factors listed increase the risk of thermal necrosis.Correct Answer: Use of fiberglass

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2357. (3624) Q5-6506:

Which shape of the olecranon apophysis correlates most closely with closure of the triradiate cartilage of the hips:

1) Formation of initial ossification center
3) Formation of a curved single ossification center
2) Initial appearance of two ossification centers
5) Closure of the olecranon ossification center
4) Formation of a rectangular ossification center

The olecranon ossifies from two centers that merge and form one banana-shaped ossification center. When the ossificaiton center is rectangular in shape, it correlates with closure of the triradiate cartilage of the pelvis.Correct Answer: Formation of a rectangular ossification center

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2358. (3625) Q5-6507:

A 15-year-old female patient undergoes spine fusion from T2 to the pelvis for scoliosis associated with cerebral palsy. Her past medical history is remarkable for seizure disorder, ventriculoperitoneal shunt, baclofen pump, and gastrostomy tube. Her postoperative course is complicated by disorientation and visual hallucinations on postoperative day 3, whereas she had been communicative preoperatively. The most likely cause of this change is:

1) Seizure activity
3) Sepsis
2) Postoperative anemia
5) Hydrocephalus
4) Baclofen withdrawal syndrome

This patient most likely has baclofen withdrawal due to interference with the catheter at some point along its path to the thecal sac. Baclofen withdrawal is characterized by increased spasticity, pruritus, hyperthermia, delusions, and hallucination. The pump reservoir should be checked, and a leak may be confirmed by filling the reservoir with a radionuclide and performing a scan. Treatment involves repleting baclofen by oral or intrathecal means and fixing the leak.Correct Answer: Baclofen withdrawal syndrome

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2359. (3626) Q5-6508:

A 5-year-old patient with Legg-CalvÃ©-Perthes disease has lateral pillar B involvement. He has 15% epiphyseal extrusion. Treatment should consist of:

1) Observation
3) Iliac osteotomy
2) Femoral osteotomy
5) External fixation
4) Combined femoral and iliac osteotomy

Patients who have Legg-CalvÃ©-Perthes disease with onset before 6 years of age have a good prognosis unless they have lateral pillar involvement in the B/C border or C categories.Correct Answer: Observation

---

2360. (3627) Q5-6509:

Which of the following characteristics is more commonly found in patients with Meyer dysplasia than in patients with Legg-CalvÃ©-Perthes disease:

1) Bilateral involvement
3) Metaphyseal widening
2) Asynchronous onset
5) Later degenerative change
4) Epiphyseal extrusion

Meyer dysplasia is a rare condition that affects children before age 4. A characteristic of the condition includes delayed ossification of the epiphyses, which eventually develop normal ossification. Meyer dysplasia is synchronous, meaning that both heads have symmetrical involvement unlike Legg-CalvÃ©-Perthes disease. Meyer dysplasia is usually bilateral, in contrast to Legg-CalvÃ©-Perthes disease, which is bilateral in fewer than 10% of patients. There is no metaphyseal widening and no treatment is indicated.Correct Answer: Bilateral involvement

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2361. (3733) Q5-7513:

A 10-year-old girl is seen for limb-length inequality. She has 10Â° of valgus of the left knee and a shortened left fibula. Her projected shortening at maturity is 1 cm in the left femur and 2.1 cm in the left tibia. Her left foot is normal in shape but one-half size smaller than the right. Her overall height and maturity are at the median for her age. For this patient, recommended treatment for limb-length inequality is:

1) Observation
3) Epiphysiodesis of the right tibia
2) Epiphysiodesis of the left tibia
5) Lengthening of the left tibia
4) Shortening of the right tibia

This patient has a projected discrepancy at maturity of 3.1 cm. Most experts agree that the risk of later gait disturbance or back pain is increased above a normal threshold when limb length inequality exceeds 2.5 cm. A shoe lift is noninvasive but not likely to be permanently adopted. Epiphysiodesis of the right tibia is the least invasive and least complicated option for permanent equalization and should be performed in this patient. Shortening of the right tibia would be an option if the patient desired correction after skeletal maturity, but is a more invasive procedure with risk of compartment syndrome, nonunion, and pain. Lengthening of the left tibia is a valid option, which could also allow correction of the valgus and maintenance of stature. However, the procedure leaves scars and complications are more significant. Most surgeons would not think that it is worthwhile for gain of an inch because a left tibial hemiepiphysiodesis could easily correct the valgus.

Correct Answer: Epiphysiodesis of the right tibia

2362. (3739) Q5-7519:

Which of the following is an accurate mean age for a motor milestone:

1) Sit up without assistance at 6 months
3) Hop on one foot at 2 years
2) Walk independently at 24 months
5) Able to run at 36 months
4) Roll from prone to supine position at 2 months

Motor milestones provide a way of assessing a childâs motor development. If they are not met, a physician or parent may be more alert for neurological or connective tissue disorders.

Common pediatric milestone include:

- Sit up without assistance at 6 months
- Walk independently at 12 months
- Hop on one foot at 4 years
- Roll from prone to supine position at 4 months
- Able to run at 18 months

Correct Answer: Sit up without assistance at 6 months

2363. (3740) Q5-7520:

In the workup of scoliosis, what is/are the best method(s) to assess skeletal maturity during a patientâs peak height velocity (Risser grade 0):

1) Greulich and Pyle atlas (hand/wrist radiographs)
3) Tanner-Whitehouse-III RUS (radius, ulna, small bones of hand) method
2) Modified Sauvegrain method (olecranon radiographs)
5) B, C, and D
4) Triradiate cartilage closure

Precise information about skeletal maturity during peak growth rate is important in deciding treatment options in patients with scoliosis. The modified Sauvegrain method, Tanner-Whitehouse-III RUS method, and triradiate cartilage closure are each accurate and reliable markers of maturity that the orthopedic surgeon can use to quickly assess pediatric patients.

Correct Answer: B, C, and D

2364. (3741) Q5-7521:

Following triple arthrodesis, total ankle range of motion is:

1) Not affected because the tibiotalar joint is not fused in a triple arthrodesis
3) Is increased in plantarflexion only; dorsiflexion is unchanged
2) Is increased because it must compensate for the loss of motion through the hindfoot joints
5) Is decreased in plantarflexion only; dorsiflexion is unchanged
4) Is decreased in both dorsiflexion and plantarflexion

Total ankle motion is a combination of tibiotalar motion as well as motion in the hindfoot joints. A 10-year follow-up study by Smith and colleagues evaluated the change in range of motion following triple arthrodesis. The authors found a 27% loss of ankle plantarflexion following triple arthrodesis, but no loss of dorsiflexion. Despite this loss of motion, 93% of patients were satisfied at average 10-year follow-up.

Correct Answer: Is decreased in plantarflexion only; dorsiflexion is unchanged

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2365. (3824) Q5-7607:

Three years ago, a 20-year-old female patient underwent posterior spinal fusion for adolescent idiopathic scoliosis. She asks what would happen if the implants were removed. The surgeonâs most likely response will be:

1) The spine will not change alignment, if the fusion is solid.
3) The scoliosis is likely to increase, even if the fusion is solid.
2) The sagittal alignment will likely change, even if the fusion is solid.
5) Increased back pain is likely.
4) Fracture of the fusion mass is likely.

After removal of implants, the sagittal alignment is likely to change, with kyphosis increasing by 10Âº in nearly half of all patients and by more than 20Âº in 10% of patients. By contrast, scoliosis increases significantly in only 5% of patients. Most patients who have implants removed experience an improvement in symptoms. Fracture of the fusion mass is rare.

Correct Answer: The sagittal alignment will likely change, even if the fusion is solid.

2366. (3825) Q5-7608:

Which of the following factors best predicts the risk of disk degeneration in young adults:

1) Smoking history
3) Gender
2) Occupational exposure
5) Participation in sports
4) Family history

Genetic factors are most predictive of disk degeneration. However, various genes have been identified as possible causative factors, possibly operating in different ways and interacting with environmental and other factors.

Correct Answer: Family history

2367. (3826) Q5-7609:

Which of the following treatments decreases hip subluxation in patients with cerebral palsy who have displaced hips:

1) Passive stretching
3) Hip abduction bracing and botulinum toxin type A
2) Hip abduction bracing
5) Surgical adductor lengthening
4) Electrical stimulation of the hip abductors

Only hip adductor lengthening has been shown to decrease hip subluxation in patients with displaced hips. Patients treated with botulinum toxin type A and hip abduction still result in progression.

Correct Answer: Surgical adductor lengthening

2368. (3827) Q5-7610:

Which of the following groups is not at increased risk for community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA):

1) Athletes who participate in physical contact sports
3) People traveling abroad
2) Patients who have had recent antibiotics
5) Prison inmates
4) People living in crowded conditions

People traveling abroad are not considered at increased risk for CA-MRSA. Athletes who participate in physical contact sports, patients who have had recent antibiotics, people living in crowded conditions, and prison inmates are considered at increased risk for CA-MRSA.

Correct Answer: People traveling abroad

2369. (3828) Q5-7611:

Which of the following toxins is responsible for the virulence of community-acquired methicillin-resistant Staphylococcus aureus (CA-MRSA):

1) Beta-lactam
3) Oxazolidine
2) Panton-Valentine leukocidin
5) Streptolysin
4) mecA

Panton-Valentine leukocidin is a toxin that produces necrosis of tissue and white blood cells. This toxin is much more common in CA-MRSA than in hospital-acquired MRSA.

Correct Answer: Panton-Valentine leukocidin

2370. (3829) Q5-7612:

A 5-year-old girl presents to the emergency department with pain in her hip. Her temperature is 102Â° F, pulse is 96, and blood pressure is 104/60. Magnetic resonance imaging reveals edema in the obturator muscles. Blood cultures are negative. Ultrasound-guided aspiration reveals no abscess, but fluid obtained grows methicillin-resistant Staphylococcus aureus (MRSA). In addition to antibiotic treatment, what other treatment option is recommended:

1) Surgical irrigation and debridement
3) Repeated aspiration with ultrasound guidance
2) Indwelling catheter drainage
5) Spica cast application
4) Observation

This patient has community-acquired MRSA but does not have an evident fluid collection. There is no evidence of systemic infection or necrotizing fasciitis. There is no indication for drainage or debridement of any type. Therefore, antibiotics alone with clinical observation are indicated.

Correct Answer: Observation

2371. (3830) Q5-7613:

A 5-year-old girl who presents to the emergency department has obturator muscle infection without abscess formation, which is seen on magnetic resonance imaging. She has no clinical evidence of sepsis. Aspiration yields methicillin-resistant Staphylococcus aureus (MRSA). Which of the following antibiotics is recommended:

1) Vancomycin
3) Rifampin
2) Clindamycin
5) Linezolid
4) Tetracycline

To treat this patient, clindamycin is the drug of choice. Vancomycin is not recommended for uncomplicated MRSA in the nonseptic patient. Rifampin is not recommended to be used alone because of the rapid development of resistance. Tetracycline is not recommended for children under 8 years old because it causes permanent staining of the teeth. Linezolid is to be used only after infectious disease consultation because of its toxicity (thrombocytopenia in 3.5% of patients) and expense. Another option for this patient would be trimetoprim/sulfamethoxazole.

Correct Answer: Clindamycin

2372. (3831) Q5-7614:

A nonverbal 12-year-old patient with totally involved cerebral palsy and developmental delay has been in pain for the past week. The source of the pain cannot be localized. Pelvis radiographs and urinalysis are unremarkable. The next recommended study is:

1) Ultrasound of the hips
3) Whole-body bone scan
2) Magnetic resonance imaging (MRI) of the brain
5) Thermography
4) Computed tomography (CT) of the lumbar spine

In a nonverbal child with longstanding pain, the whole-body bone scan is the most sensitive and specific test. Whole-body bone scans detected a cause of pain in more than half of such children in one study; most causes of pain were fractures. MRI cannot be focused enough, and CT has the same limitation as well as increased radiation exposure. Thermography is not widely available and has not been studied in children with cerebral palsy.

Correct Answer: Whole-body bone scan

2373. (3832) Q5-7615:

A 2-month-old infant has a midshaft humeral fracture. The fracture has 45Â° angulation with an anterolateral apex and is 6 mm short. Recommended treatment includes:

1) Immobilizing the arm against the torso
3) Percutaneous pin fixation
2) A shoulder abduction cast
5) External fixation
4) Plate fixation

The humerus has unlimited remodeling potential at this age. The goal of treatment is pain relief. Immobilization against the torso is the most practical method of treatment.

Correct Answer: Immobilizing the arm against the torso

2374. (3833) Q5-7616:

A 23-month-old patient demonstrates intoeing. He walked at 21 months. His height is in the 3rd quantile, and he is cognitively normal. Possible diagnoses include all of the following except:

1) Osteogenesis imperfecta
3) Internal tibial torsion
2) Rickets
5) Metaphyseal chondrodysplasia
4) Achondroplasia

The upper limit of normal age for onset of walking is 18 months. All of the diagnoses, except for internal tibial torsion, may explain the delayed walking, short stature, and intoeing.

Correct Answer: Internal tibial torsion

2375. (3834) Q5-7617:

The most common form of rickets in the United States is:

1) Nutritional deficiency of calcium
3) Vitamin D-dependent rickets (1-alpha-hydroxylase deficiency)
2) Hypophosphatasia
5) X-linked hypophosphatemic rickets
4) Fanconi syndrome

Although rickets due to deficiency of vitamin D is common due to inadequate sunlight or prolonged breast feeding, nutritional deficiency of calcium is uncommon in the US. The most common cause of rickets in the US is X-linked hypophosphatemic rickets. Hypophosphatasia, caused by alkaline phosphatase deficiency, is a rare recessive condition. Fanconi syndrome is a failure of tubular reabsorption of small molecules and resembles X-linked hypophosphatemic rickets, although it is more rare. Vitamin D-dependent rickets is also rare.

Correct Answer: X-linked hypophosphatemic rickets

2376. (3835) Q5-7618:

The gene most likely to be associated with inherited rickets is:

1) PHEX
3) SLC34A3
2) FGF23
5) COL1A1
4) EXT1

PHEX is a gene whose product regulates transport of renal phosphates that leads to isolated renal phosphate wasting and consequent hypophosphatemia. This is the syndrome known as X-linked hypophosphatemic rickets, which is the most common cause of inherited rickets.

Correct Answer: PHEX

2377. (3836) Q5-7619:

Genetic testing performed for a patient reveals a defect in PHEX. The family history provided by the patient is most likely to include:

1) An affected father and son in the family
3) A negative family history for the disorder
2) More females relatives affected than male relatives
5) Affected siblings but no prior ancestors or relatives
4) An equal number of affected male relatives and females relatives

PHEX is the gene for a product that regulates renal tubular phosphate reabsorption. A defect in this gene causes X-linked hypophosphatemic rickets, which is the most common inherited rickets. It is an X-linked dominant condition; therefore, male-to-male transmission cannot occur. An excess of affected female relatives to male relatives is approximately 2:1. Spontaneous mutation can occur but is less common than inheritance of the disorder.

Correct Answer: More females relatives affected than male relatives

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2378. (3837) Q5-7620:

A toddler with bowing is suspected of X-linked hypophosphatemic rickets (XLH). The most likely laboratory abnormalities will include:

1) Low alkaline phosphatase
3) Low calcium
2) High PO4
5) Low 1,25-(OH)2D3
4) Low 25-(OH)2D3

The most common laboratory abnormalities in XLH include high alkaline phosphatase (in attempt to mobilize phosphate from the bone); low serum phosphate; normal calcium and 25-(OH)2D3; and low 1,25-(OH)2D3, presumably due to defective renal hydroxylation.

Correct Answer: Low 1,25-(OH)2D3

2379. (3838) Q5-7621:

An 18-month-old patient is suspected of X-linked hypophosphatemic rickets. The clinical findings are most likely to include all of the following except:

1) Below average stature
3) Dental abscesses or caries
2) Exaggerated genu varus
5) Alopecia
4) Delayed motor milestones

Patients with X-linked hypophosphatemic rickets may present with below average stature, exaggerated genu varus, dental abscesses or caries, and delayed motor milestones. Alopecia is not common in patients with this condition but is characteristic of the rare condition of end-organ insensitivity to vitamin D (vitamin D-resistant rickets).

Correct Answer: Alopecia

2380. (3839) Q5-7622:

A newborn is brought in for consultation due to a foot deformity. The left foot is dorsiflexed at the ankle, and the dorsum of the foot is able to be placed against the tibia. Neurologic and vascular examination is normal. Recommended treatment includes:

1) Magnetic resonance imaging for completion of diagnosis
3) Observation
2) Serial casting
5) Lengthening of the anterior tibialis tendon
4) Ankle-foot orthosis

The newborn is presenting with a calcaneovalgus foot. This condition resolves spontaneously, therefore, no additional work-up is needed.

Correct Answer: Observation

2381. (3840) Q5-7623:

In a newborn, how much angulation is acceptable in a fracture of the humeral diaphysis:

1) 10Â°
3) 30Â°
2) 20Â°
5) 50Â°
4) 40Â°

In the humeral diaphysis of a newborn, one can accept virtually any alignment because of the tremendous remodeling capacity of the child. Complete remodeling of 66Â° within 1 year has been documented.

Correct Answer: 50Â°

2382. (3841) Q5-7624:

Which of the following radiographic parameters remains essentially fixed throughout life:

1) Pelvic tilt
3) Pelvic incidence
2) Sacral slope
5) Lumbar lordosis
4) T1 tilt

Pelvic incidence is a measure of the relationship between the superior sacral endplate and the hips. It does not change significantly during life unless there is a major pelvic fracture. Pelvic incidence is defined as the angle between a line connecting the hip center and the midpoint of the S1 endplate, and a perpendicular to the midpoint of the S1 endplate. This angle is fixed in bone. By contrast, all of the other angles vary with posture and age.

Correct Answer: Pelvic incidence

2383. (3842) Q5-7625:

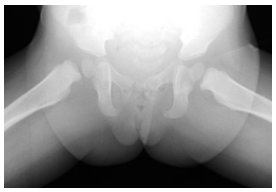
A 6-year-old boy presents with a linear area of swelling in the region of the posterior paraspinous muscles. He has no history of weight loss or fevers. He also has bilateral great toe deformities consisting of valgus and shortening. The most likely diagnosis is:

1) Multiple hereditary exostoses
3) Osteosarcoma
2) Ewingâs sarcoma
5) Synovial sarcoma
4) Fibrodysplasia ossificans progressiva

Fibrodysplasia ossificans progressiva is characterized by linear swelling and progressive ossification from a posterior-central origin. Patients also have a characteristic shortened and valgus great toe. The natural history of this disorder is one of progressive ossification, and it eventually impairs nutrition.

Correct Answer: Fibrodysplasia ossificans progressiva

2384. (3843) Q5-7626:



Slide 1 **Slide 2**

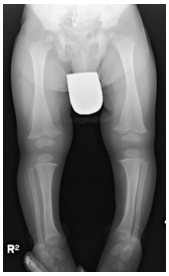
Based on the presented radiographs (Slide 1, Slide 2), what is the proper diagnosis of this 12-month-old female patient:

1) Normal study
3) Developmental coxa vara of the right femur
2) Avascular necrosis of the femoral head
5) Osteogenesis imperfecta
4) Physeal fracture

This patient had a physeal fracture of the right proximal femur, which was the result of a non-accidental injury. Notice the displacement of the right femoral metaphysic anteriorly on the frog view despite comparable degrees of rotation. A metaphyseal calcification is apparent posterior to the femoral neck. Treatment involved spica cast application.

Correct Answer: Physeal fracture

2385. (3844) Q5-7627:



Slide

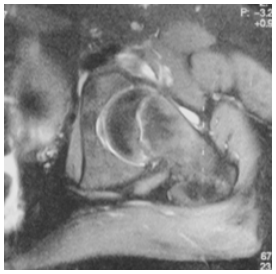
A 23-month-old patient is evaluated for intoeing. Based on his radiograph (Slide), what is the most likely diagnosis:

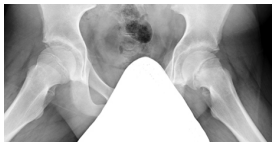
1) Osteogenesis imperfecta
3) Physiologic bowing
2) Tibial torsion
5) Fibrous dysplasia
4) Rickets

This patient has rickets. Note the diffuse osteopenia, âgrainyâ nature, thinning of the tibial and femoral diaphyseal cortex, varus of both the proximal and distal tibial metaphyses, and widened and irregular physes at all levels.

Correct Answer: Rickets

2386. (3845) Q5-7628:





Slide 1 **Slide 2** **Slide 3**

A 13-year-old boy has been experiencing hip pain for 1 month. The pain is worse with activity. The patient has no history of fever or weight loss, and both of his hips flex to 90Â°. Based on his radiograph (Slide 1) and magnetic resonance image (Slide 2), which of the following is the most likely diagnosis:

1) Leukemia
3) Psoas tendonitis
2) Pincer-type impingement
5) Avascular necrosis
4) Slipped epiphysis

This patient has a subtle grade 1 slipped capital femoral epiphysis. He is a male Risser 0 and is overweight. He has decreased internal rotation of the involved hip in flexion. The plain pelvis radiograph shows slightly less epiphyseal height on the left side, slight posterior metaphyseal overlap, and increased irregularity of the physis. MRI confirms a lucent plane in the physis and surrounding edema. A plain film (Slide 3) confirms the diagnosis. In situ fixation was performed on this patient.

Correct Answer: Slipped epiphysis

2387. (3846) Q5-7629:

Slide 1 Slide 2 Slide3

A 13-year-old boy has been experiencing hip pain for 1 month. The pain is worse with activity. The patient has no history of fever or weight loss, and both of his hips flex to 90Â°. Based on his radiograph (Slide 1) and magnetic resonance image (Slide 2), which of the following is the most likely diagnosis:

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2) Pincer-type impingement
5) Avascular necrosis
4) Slipped epiphysis

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Correct Answer: Slipped epiphysis

2388. (3847) Q5-7630:

Slide

A 9-year-old girl sustains an injury (Slide) as a result of a fall. What is her risk of avascular necrosis:

1) 95%
3) 50%
2) 75%
5) 5%
4) 25%

This patient has a displaced basicervical fracture of the femur that is classified as Delbet type III. The risk of avascular necrosis is approximately 20% to 25%. She should be monitored closely for the first 12 to 18 months after injury for this complication.

Correct Answer: 25%

2389. (3848) Q5-7631:

Slide 1

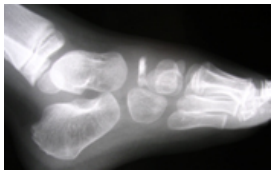
A 9-year-old girl sustains an injury (Slide 1) as a result of a fall. What is the recommended treatment:

1) Traction
3) Closed reduction and Steinmann pin fixation
2) Closed reduction and spica cast application
5) Open reduction and fixation with hip screw
4) Open reduction and Steinmann pin fixation

This patient has a basicervical fracture, which is prone to development of varus. Traction, spica cast, and Steinman pin fixation do not provide adequate control of this process. Steinmann pins do not allow compression across the fracture site. Closed or open reduction and internal fixation with a compression screw fixation, preferably a hip screw, provide the best control of the fracture. A hip screw provides the best protection against the development of varus. If the fracture is not opened, then aspiration of the hematoma is recommended.

Correct Answer: Open reduction and fixation with hip screw

2390. (3849) Q5-7632:



Slide

A 6-year-old boy presents with a 3-month history of medial midfoot pain. Based on his radiograph (Slide), which of the following is the correct diagnosis:

1) Kohlerâs disease
3) Eosinophilic granuloma
2) Pannerâs disease
5) Freibergâs disorder
4) Accessory navicular

This child has avascular necrosis of the tarsal navicular. This is an idiopathic phenomenon more common in boys of this age than girls. The condition responds to rest and orthotics or cast immobilization. The navicular revascularizes over the ensuing year.

Correct Answer: Kohlerâs disease

2391. (3917) Q5-7797:

Which of the following syndromes has the highest incidence of scoliosis as a percentage of affected patients:

1) Marfan syndrome
3) Down syndrome
2) Loeys-Dietz syndrome
5) Prader-Willi syndrome
4) Rett syndrome

Marfan syndrome, due to a mutation in fibrillin-1, causes spinal deformity in two-thirds of patients. Rett syndrome, caused by a mutation in MECP-2, results in neurological balance disorder and may cause scoliosis in up to half of affected patients. Scoliosis is seen in smaller numbers of patients with Prader-Willi, Down, and Loeys-Dietz syndromes.

Correct Answer: Marfan syndrome

2392. (254) Q6-367:

Acute pain that presents in the lateral arm and shoulder is suggestive of:

1) Cervical myelopathy
3) Radial tunnel syndrome
2) Thoracic outlet syndrome
5) Diabetic neuropathy
4) Cervical disk herniation

Acute radiculopathies of the upper extremity are suggestive of soft cervical disk herniations. Three types of soft disk herniations have been described:

- Intraforaminal is the most common and is often evidenced by radicular symptoms in a dermatomal distribution.
- Posterolateral herniation results in predominantly motor symptoms.
- Midline disk herniations may result in myelopathy.

Correct Answer: Cervical disk herniation

2393. (255) Q6-368:

A cervical disk herniation that causes weakness in the wrist extensors will likely produce sensory changes in the:

1) Lateral arm
3) Radial forearm
2) Ulnar forearm
5) Hypothenar eminance
4) Long finger

The wrist extensors are innervated by C6. Weakness would likely be the result of a C5-C6 cervical disk herniation, thus causing a C6 radiculopathy. The dermatome of C6 includes the radial side of the forearm and radial digits.Correct Answer: Radial forearm

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2394. (256) Q6-369:

In order to diagnose a disk herniation, the preferred test is:

1) Electromyogram
3) Computerized tomography scan
2) Flexion-extension roentgenograms
5) MRI without gadolinium
4) Magnetic resonance imaging (MRI) with gadolinium

Magnetic resonance imaging (MRI) has become the modality of choice for diagnosis of disk herniation. It is readily available, noninvasive, and has proven as accurate as post-myelogram computerized tomography scans in the evaluation of cervical radiculopathy. An MRI study should include a T1- and T2-weighted image sequence with both sagittal and axial images.Correct Answer: MRI without gadolinium

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2395. (257) Q6-370:

Initial management of cervical radiculopathy includes all of the following except:

1) Nonsteroidal anti-inflammatory drugs
3) Physical therapy
2) Cervical immobilization
5) Home traction
4) Anterior cervical discectomy and fusion

Initial management of cervical radiculopathy is nonoperative. This includes:

- Nonsteroidal anti-inflammatory drugs
- Occasional narcotic analgesic medications
- Immobilization in a soft collar for 10 to 14 days
- Physical therapy with emphasis on isometric exercises
- Home traction

Surgical intervention is indicated for patients who fail nonoperative treatment. Motor deficits intertractable pain may serve as indication for early surgical therapy. In addition, patients with intertractable pain or motor deficits may be recommended for early surgery.Correct Answer: Anterior cervical discectomy and fusion

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2396. (258) Q6-371:

Figure 1

This patient has a wide-based gait and hyper-reflexia in his lower extremities. His magnetic resonance image is presented. Other physical findings in this patient would likely include:

1) Negative Hoffman sign
3) Carpal tunnel syndrome
2) Negative Babinski sign
5) Thoracic outlet syndrome
4) Hand intrinsic wasting

This patientâs clinical presentation is suggestive of cervical spondylotic myelopathy. The T2 sagittal magnetic resonance image shows multiple areas of spinal cord compression due to spondylosis. In this situation, one sees evidence of upper motor neuron dysfunction in the lower extremites such as hyper-reflexia, Hoffman sign, clonus, wide-based gait, and sexual or bladder dysfunction. The upper extremities may demonstrate upper and lower motor neuron findings, hypo-reflexia or hyper-reflexia, crossed radial reflex, Hoffman sign, and hand intrinsic wasting.Correct Answer: Hand intrinsic wasting

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2397. (259) Q6-372:

A useful test to differentiate cervical radiculopathy from diabetic peripheral neuropathy is:

1) Hemoglobin A1C
3) Computerized tomography-myelogram
2) Magnetic resonance imaging
5) Cervical flexion/extension roentgenograms
4) Electrodiagnostic testing

An electromyogram detects motor changes as a result of nerve compression. It can be used to differentiate cervical radiculopathy from peripheral neuropathy.Correct Answer: Electrodiagnostic testing

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2398. (260) Q6-373:

With a left-sided anterior cervical spine approach, the structure at increased risk for injury is the:

1) Recurrent laryngeal nerve
3) Hypoglossal nerve
2) Superior laryngeal nerve
5) Esophagus
4) Thoracic duct

On the left side of the neck, the thoracic duct ascends lateral to the carotid sheath and is at potential risk for laceration with resulting chylothorax. This potential risk must be avoided by remaining medial to the carotid sheath during the left-sided anterior cervical spine approach.Correct Answer: Thoracic duct

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2399. (261) Q6-374:

With a right-sided anterior cervical spine approach, the structure at increased risk is the:

1) Recurrent laryngeal nerve
3) Hypoglossal nerve
2) Superior laryngeal nerve
5) Esophagus
4) Thoracic duct

The left recurrent laryngeal nerve enters the thorax within the carotid sheath before looping around the aortic arch and ascending into the neck between the trachea and the esophagus. On the right side, the nerve exits the carotid sheath at a higher level, making the nerve susceptible to injury during the surgical dissection.Correct Answer: Recurrent laryngeal nerve

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2400. (262) Q6-375:

The structure most at risk during lateral mass screw placement is the:

1) Vertebral artery
3) Spinal cord
2) Nerve root
5) Thoracic duct
4) Recurrent laryngeal nerve

Lateral mass screws placed in the cervical spine for plate fixation are directed 30Â° lateral and 15Â° cephalad from a point 1 mm medial to the mid-portion of the particular pillar. The nerve root exits at the anterolateral portion of the facet joint and is at risk of injury. The vertebral artery may be injured in screws placed too medially. The spinal cord is essentially free of danger with accepted techniques.Correct Answer: Nerve root

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2401. (263) Q6-376:

After undergoing an anterior cervical discectomy and fusion through a left-sided neck incision, the patient is noted to have a drooping eyelid and a right pinpoint pupil. This is likely due to:

1) Spinal cord injury
3) Retractor placement
2) Nerve root injury
5) Vertebral artery injury
4) Carotid sheath compression

This patient has postoperative Horner syndrome. The sympathetic chain lies lateral to the longus colli muscles. Retractors must be placed deep into these muscles. Retractors placed ventrally to the longus colli muscles can cause injury to the sympathetic chain, esophagus medially, and carotid sheath contents laterally.Correct Answer: Retractor placement

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2402. (264) Q6-377:

After an anterior cervical discectomy and fusion with autogenous iliac crest bone graft, the patient reports numbness in the lateral thigh. This is due to:

1) Nerve root injury
3) Lateral femoral cutaneous nerve injury
2) Intraoperative positioning
5) Sciatic nerve injury
4) Genitofemoral nerve injury

The lateral femoral cutaneous nerve emerges from the lateral border of the psoas major muscle and crosses the ilium as it runs toward the anterior superior iliac spine. The course of the nerve is variable. The nerve is at risk of injury, with resulting meralgia paresthetica, in approximately 10% of patients.Correct Answer: Lateral femoral cutaneous nerve injury

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2403. (265) Q6-378:

One advantage of posterior laminoforaminotomy in the treatment of cervical radiculopathy is:

1) Obviates the need for fusion
3) Easier access to midline disk herniations
2) Improves nerve root decompression
5) Improves postoperative alignment
4) Improves wound healing

The posterior cervical foraminotomy has a surgical success rate similar to an anterior cervical discectomy and fusion. Proponents argue that the posterior procedure obviates the need for fusion, therefore, postoperative immobilization is unnecessary. The posterior approach cannot address segmental kyphosis or recreate disk space height.Correct Answer: Obviates the need for fusion

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2404. (266) Q6-379:

The most frequently involved spinal segment in rheumatoid arthritis is:

1) C1-C2
3) C5-C6
2) C7-T1
5) L5-S1
4) T12-L1

C1-C2 is the most frequently involved spinal segment in rheumatoid arthritis (RA), and it is also the most clinically significant. These articulations are exclusively synovial and the primary target of RA.Correct Answer: C1-C2

2405. (267) Q6-380:

The most useful measurement for predicting neurological deficit in rheumatoid arthritis involvement of the cervical spine is:

1) Flexion angle
3) Anterior atlantodens interval (AADI)
2) Posterior atlantodens interval (PADI)
5) C2-C3 disk height
4) Lordosis angle

The posterior atlantodens interval (PADI) is the distance between the posterior surface of the dens and the anterior edge of the posterior ring of C1, as seen on a lateral radiograph. A PADI $\leq$ 14 mm was 97% sensitive in predicting the presence of neurological deficit. Patients with a PADI >14 mm had a 94% chance of being neurologically intact.Correct Answer: Posterior atlantodens interval (PADI)

2406. (268) Q6-381:

A relative contraindication to cervical laminectomy for the treatment of cervical spondylosis is:

1) Positive Babinski sign
3) Positive Hoffman sign
2) Cervical lordosis
5) Cervical kyphosis
4) Wrist extensor weakness

Cervical laminectomy for spondylosis is performed to allow the spinal cord to migrate posteriorly in order to decompress the spine. This can be accomplished only if the spine is lordotic. If kyphosis exists, then the cord may remain draped over anterior osteophytes and continued compression may exist. In cases of cervical kyphosis, anterior decompression is preferred.Correct Answer: Cervical kyphosis

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2407. (269) Q6-383:

The major risk factor for nonunion in a type 2 odontoid fracture is:

1) Age >35 years old
3) Anterior displacement >5 mm
2) Posterior displacement >5 mm
5) Flexion 30Â°
4) Smoking history

A posterior displacement >5 mm has the greatest risk of nonunion. However, age >65 years old is a next risk factor. Type 2 odontoid fractures have the highest rate of nonunion of the 3 types and there has been reported to be >60% nonunion when not treated with a halo immobilization. Halo traction is a viable alternative for a patient who has minimal displacement and/or is not a candidate for surgery.Correct Answer: Posterior displacement >5 mm

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2408. (270) Q6-384:

A 48-year-old man presents with a closed head injury requiring intubation and isolated bilateral facet dislocation. The next appropriate step is:

1) Closed reduction with axial traction with Gardner-Wells tongs
3) Emergent magnetic resonage imaging
2) Posterior open reduction and posterior cervical platting
5) Administration of Decadron (Merck & Co., West Point, Pa.) 10 mg/hr intravenously
4) Neurostabilization until the patientâs neurologic status improves

The patient has a severe closed head injury and is unable to tolerate a close reduction maneuvers with Gardner-Wells tongs. Emergent magnetic resonance imaging should be obtained to evaluate the potential presence of a disk herniation at the dislocation. Should a disk herniation be present, anterior approach and diskectomy should be performed prior to reduction maneuvers.Correct Answer: Emergent magnetic resonage imaging

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2409. (271) Q6-385:

A major indication for surgical decompression of an L1 burst fracture is:

1) Loss of anterior body height of 60%
3) Kyphosis of 15Â°
2) Retropulsion of canal fragments to 50% of canal size
5) Presence of a posterior lamina fracture
4) Post-void residual of 450 mL

Generalized treatment algorithms for burst fractures involving upper lumbar spine have relative indications for surgery that include 50% loss of height, 25% of kyphosis, and 50% canal compromise. Absolute indications for decompression include neurological deficits including a potential conus injury. Post-void residual of > 450 mL is suggestive of sacral root injury at the level of conus. Bradford suggests that anterior decompression of this injury has favorable outcome with frequent resolution or improvement of symptoms.Correct Answer: Post-void residual of 450 mL

2410. (272) Q6-386:

An injury associated with a type 1 fracture of the odontoid is:

1) Concomitant fracture of the body at C2
3) Atlanto-occipital dislocation
2) Burst fracture of the lumbar spine
5) Associated Jefferson fracture of the ring of C1
4) Rupture of the transverse ligament

Type 1 fractures are a rare entity. They are frequently treated with immobilization with a hard collar if isolated. There have been numerous reports in the literature of a type 1 fracture of the odontoid being associated with an atlanto-occipital dislocation, and this injury must be suspected. The potential for missing atlanto-occipital dislocation may lead to a fatal outcome.Correct Answer: Atlanto-occipital dislocation

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2411. (273) Q6-387:

A type 3 traumatic spondylolisthesis of the axis, as classified by Levine and Edwards, is best treated with which of the following:

1) Soft collar immobilization
3) Halo vest immobilization
2) Hard Philadelphia cervical orthosis
5) Gardner-Wells tongs application and awake reduction, then posterior stabilization
4) Open reduction and operative posterior stabilization

The Levine classification of traumatic spondylolisthesis or Hangman fractures involving C2 in the type 3 injury has a combined bilateral facet dislocation at C2-C3 as well as the traumatic spondylolisthesis of the axis. Closed reduction could not be performed secondary to the traumatic spondylolisthesis at the C2 isthmus.Correct Answer: Open reduction and operative posterior stabilization

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2412. (274) Q6-389:

A type 3 Anderson and Montensano fracture of the occipitocondyle is best described as:

1) An impacted comminuted fracture of the occipital condyle
2) An occipital condyle fracture associated with a basilar skull fracture
5) A crush injury to the occipital condyle in the face of underlined osteoarthritis
4) An occipital condyle avulsion fracture from the alar ligament
) An occipital condyle-axial dislocation

A type 3 fracture of the occipital condyle is an avulsion fracture from traction of the alar ligament. This usually results from a rotation, lateral bending moment, or combined injury. If the injury is severe, both alar ligaments may be involved and occipitocervical instability may occur. Treatment for a type 3 injury would include a rigid or collar orthosis for 8 to 12 weeks, possible halo mobilization, and, if ligamentous instability has occurred, posterior cervical fusion.Correct Answer: An occipital condyle avulsion fracture from the alar ligament

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2413. (275) Q6-390:

An 8-year-old boy has had torticollis for approximately 5 weeks. He has undergone immobilization with a cervical collar without success. The patient has not undergone traction and now has atlantoaxial rotatory subluxation. The best treatment for this patient should be:

1) Continued treatment in hard cervical orthosis
3) Hospitalization with cervical traction
2) Manipulation and closed reduction of his deformity
5) Application of halo vest and reduction
4) Posterior C1-C2 fusion

The treatment protocol for atlantoaxial rotatory subluxation is based on the onset and length of time of deformity. Soft collar treatment for this deformity is best if treated within 1 week of onset. For deformities lasting up to 1 month, in-house hospitalization with traction is warranted. However, the success of this treatment declines markedly after 1 month, at which time posterior C1-C2 fusion is warranted.Correct Answer: Posterior C1-C2 fusion

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2414. (276) Q6-391:

During posterior cervical plating, several techniques can be employed. The recommended lateral mass screw position is:

1) 10Â° laterally, 90Â° perpendicular to the lateral mass
3) 30Â° laterally and 15Â° cephalad
2) 50Â° cephalad and 30Â° laterally
5) 60Â° laterally and 30Â° medially
4) 15Â° laterally and 30Â° cephalad

Surgical technique for cervical lateral mass fixation as described by An and colleagues is 30Â° of Lateral angulation and 15Â° of angulation cephalad to the facet joint.. This has been described as the safest recommended technique for lateral mass screw placement.Correct Answer: 30Â° laterally and 15Â° cephalad

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2415. (277) Q6-392:

A 35-year-old man presents 3 years after a motor vehicular trauma. It is now 3 years following operative stabilization of the spine at C7. He complained of mild weakness in his right upper extremity at the biceps level and has corresponding parasthesias in the right thumb. The next step in the evaluation of this patient is:

1) Anteroposterior lateral flexion extension radiographs of the cervical spine
3) Magnetic resonance imaging of the cervical spine
2) Computerized tomography scan of the cervical spine
5) Anti-inflammatory medication for presumed tendonitis
4) Physical therapy with range of motion and strengthening exercises of both upper extremities

The patient is a 35-year old man has been stable since his injury. The most important evaluation for this individual would be magnetic resonance imaging to rule out potential cervical cord syrinx that has occurred given new onset weakness and sensory changes proximal to his injury.Correct Answer: Magnetic resonance imaging of the cervical spine

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2416. (278) Q6-393:

A 55-year-old man with ankylosing spondylitis has a minor fall and is suffering with neck pain. Anteroposterior and lateral radiographs are negative with no evidence of fracture. He has no neurologic loss and has normal strength with the exception of severe restricted motion. Twelve hours following injury, he is found to have bilateral bicep and tricep weakness. The appropriate management and the work up of this individual is:

1) Computerized tomography (CT) anteroposterior lateral radiographs of the cervical spine
3) Magnetic resonance imaging (MRI) of the cervical spine
2) CT scan of the cervical spine
5) Electromyogram to better delineate all the nerve neuropathy
4) Bone scan of the MRI

The patient is within 12 hours of having normal cervical spine films. Approximately one third of patients with ankylosing spondylitis incur occult injuries to the cervical spine that are not identified by plain films prior to kyphotic progression. A bone scan would delineate a fracture after 72 hours. However, the presence of progressive weakness should raise suspicion of a potential epidural hematoma. For this reason, magnetic resonance imaging would better delineate epidural hematoma.Correct Answer: Magnetic resonance imaging (MRI) of the cervical spine

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2417. (279) Q6-394:

A 2-year-old boy with a congenital heart anomaly has a 40Â° thoracolumbar curvature. Standing posteroanterior and lateral radiographs reveal vertebral anomalies indicative of congenital scoliosis. Which of the following patterns of congenital scoliosis has the worst prognosis for progression?

1) Block vertebrae
3) Fully segmented hemivertebra
2) Unilateral unsegmented bar
5) Nonsegmented hemivertebra
4) Unilateral unsegmented bar with a contralateral fully segmented hemivertebra

Congenital spinal deformity is caused by structural abnormalities in the vertebrae that can result in asymmetric growth, such as scoliosis or kyphosis. It has been classified in 2 types. Type I involves defects of formation and type II involves defects of segmentation. However, in many instances, deformities can be a mixture of both. Defects of formation include segmented or unsegmented hemivertebrae and wedge vertebrae. Defects of segmentation include block vertebrae, unilateral bars, or unilateral bars with hemivertebrae.

The potential for progression is dependent on the growth potential of the anomalies. The presence of healthy-appearing disks between the hemivertebra and its normal counterparts indicates good growth potential and risk for progression. A unilateral bar on the opposite side of a segmented hemivertebra acts as a tether on the concave side of the curve and has the most likelihood for progression.

Children with congenital scoliosis also have a significant incidence of associated anomalies, both intraspinal and other organ systems. About 30% have a spinal dysraphism such as diastematomyelia, meningocele or lipoma. Other associated anomalies include Klippel-Feil syndrome (25%), genitourinary tract abnormalities (30%), cardiac defects (12%), and Sprengelâs deformity (10%).

Correct Answer: Unilateral unsegmented bar with a contralateral fully segmented hemivertebra

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2418. (280) Q6-395:

Six months ago, an 11-year-old premenarchal girl with adolescent idiopathic scoliosis had a right thoracic curve from T5 to T12 measuring 20Â°. Her physical examination was normal. She returned to the office and a standing posteroanterior radiograph demonstrates a 28Â° right thoracic curve from T5 to T12; she is Risser stage 0. A lateral radiograph shows a thoracic kyphosis of 10Â°. At this time, you recommend:

1) Repeat radiograph in 6 months
3) Full-time use of a thoracolumbosacral orthosis
2) Thoracic flexibility exercises
5) Posterior spinal fusion with instrumentation
4) Electrical stimulation

In skeletally immature patients with adolescent idiopathic scoliosis and curves approaching 30Â° with documented progression, bracing may be effective at preventing further progression of the curve. Risk of progression in adolescent idiopathic scoliosis is related to curve magnitude and remaining growth potential. The risk of further progression in this patient is 68%, and bracing is indicated. Electrical stimulation and physical therapy have not been shown to affect the natural history of scoliosis. Surgery may be indicated in patients with more severe curves. In the sagittal plane, hypokyphosis is usually present in adolescent idiopathic scoliosis.Correct Answer: Full-time use of a thoracolumbosacral orthosis

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2419. (281) Q6-396:

A 15-year-old boy with adolescent idiopathic scoliosis has a right thoracic curve from T5 to T11 measuring 45Â° and a left thoracolumbar curve from L1 to L4 measuring 32Â°. He is Risser stage 2 and has a hypokyphotic thoracic spine. Bending films demonstrate moderate flexibility in the lumbar curve. He was prescribed a thoracolumbosacral orthosis since age 14, but his scoliosis has progressed. His physical exam reveals a prominent right rib hump and mild right shoulder elevation. His head is centered above his pelvis. His neurological examination is normal. You recommend:

1) Continued full-time use of the orthosis until skeletal maturity
3) Repeat evaluation in 6 months
2) Discontinuation of the orthosis due to failure
5) Posterior spinal fusion of the thoracic curve only with instrumentation
4) Posterior spinal fusion T5-L4 with instrumentation

This patient has a right thoracic curve with a compensatory left lumbar curve pattern of adolescent idiopathic scoliosis. There has been documented progression into the surgical range despite bracing, and he still has some growth remaining. Surgical intervention is indicated. This curve pattern (King II, Lenke D) can be approached posteriorly with thoracic fusion alone to the neutral and stable vertebra and instrumentation to obtain and maintain correction. The unfused lumbar curve will spontaneously correct to balance the fused thoracic curve. Care must be taken to avoid fusion into the lower lumbar spine and preserve motion segments.Correct Answer: Posterior spinal fusion of the thoracic curve only with instrumentation

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2420. (282) Q6-397:

A 1-year-old male infant is referred by his pediatrician for evaluation of possible scoliosis. Otherwise, he is healthy. His physical exam reveals normal neurologic function, plagiocephaly and a flexible thoracic curve. Radiographs reveal a left thoracic curve with a Cobb angle of 36Â° and no vertebral anomalies. The apical ribs are in Phase I, and the rib-vertebral angle difference is 18Â°. At this time, management should include:

1) Observation
3) Full-time use of a thoracolumbosacral orthosis
2) Serial body casting to obtain correction
5) Spinal instrumentation without fusion
4) Posterior spinal fusion

Infantile idiopathic scoliosis is rare in this country and not well understood. It is more common in Europe, occurs more frequently in boys, and left thoracic curves predominate. Plagiocephaly, or a flattening of the posterior skull on the convex side of the spinal curvature, is frequently found in these patients, suggesting a postural cause of both.

There are 2 types of infantile idiopathic scoliosis: resolving and progressive. Distinguishing between the 2 types has obvious consequences regarding prognosis and treatment. Prior to Mehtaâs work, identification of the type of infantile idiopathic scoliosis was difficult, because it was not related to curve magnitude, age at onset, rate of progression, or degree of rotation.

Mehta showed that the 2 groups were distinguishable by the relationship of the ribs to the apical vertebral body on the posteroanterior radiograph. Ribs that do not overlap the vertebral body are in Phase I, and ribs that do overlap the vertebral body on the convexity of the curve are in Phase II. The rib-vertebral angle is constructed by the intersection of a line perpendicular to the apical vertebral endplate with a line drawn along the long axis of the corresponding rib. The rib-vertebral angle (RVA) difference is the difference of the RVA of the concave and convex ribs of the apical vertebra. In scoliosis, the convex ribs form a more acute angle than the concave ribs, so this difference is >0. Mehta concluded that curves in which the ribs are in Phase I and the RVA difference is < 20Â° have a better prognosis (resolving type) and require just observation. Treatment for progressive curves includes serial body casts, orthoses, or surgery for severe curves. Various surgical approaches include posterior spinal fusion, instrumentation without fusion to allow spinal growth, or anterior convex hemiepiphysiodesis with posterior hemiarthrodesis.Correct Answer: Observation

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2421. (283) Q6-398:

The most appropriate indication, after scoliosis curve progression, for a posterior spinal fusion with segmental instrumentation to the pelvis in a severely involved spastic quadriplegic child with cerebral palsy is:

1) Pelvic obliquity
3) Poor nutritional status
2) Deterioration in function
5) Non-ambulatory status
4) Normal pulmonary function

Patients with a spastic quadriplegic pattern of cerebral palsy have higher than 25% incidence of scoliosis. This neuromuscular scoliosis differs from that of idiopathic scoliosis in that it is usually a long C-shaped thoracolumbar curve that may involve the pelvis. Frequently, posterior spinal fusion from T1 to the sacrum is required with rigid segmental instrumentation with stabilization to the pelvis (a unit rod).

Indications for fusion in these patients include curve progression and loss of function. This can include loss of sitting ability, poor pulmonary function due to poor pulmonary toiletting, and recurrent infection such as decubitus ulcers. These children are most often non-ambulators and are dependent on wheelchair sitting supports for postural control.

Correct Answer: Deterioration in function

2422. (284) Q6-399:

A 12-year-old boy with Duchenne muscular dystrophy has a 25Â° curve in the thoracolumbar spine with moderate pelvic obliquity. His pulmonary function tests are 70% of predicted function. He uses a wheelchair for ambulation, but is able to stand for transfers. Management should include:

1) Observation, with repeat radiograph and pulmonary function tests in 6 months
3) Wheelchair seat pressure mapping and lateral trunk support modifications
2) Thoracolumbosacral orthosis
5) Anterior spinal release and posterior spinal fusion with instrumentation
4) Posterior spinal fusion with instrumentation

Scoliosis in patients with Duchenne muscular dystrophy typically becomes progressive when ambulation ceases. For curves >20Â°, posterior spinal fusion with instrumentation is indicated. Fixation to the pelvis is necessary to improve sitting if pelvic obliquity is present. Severe, collapsing scoliosis can result without operative intervention and can result in diminishing pulmonary function and loss of sitting ability. Surgery can be safely undertaken if pulmonary function remains >40% of predicted function, but anterior surgery causes morbidity on an already compromised pulmonary system. Nonoperative treatment such as orthoses or trunk supports offer little in the way of controlling progression and are generally not well tolerated by these patients.Correct Answer: Posterior spinal fusion with instrumentation

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2423. (285) Q6-400:

A 6-year-old girl with a lumbar level paraplegia secondary to myelomenigocele presents with a rapidly progressive thoracolumbar scoliosis. The most accurate test to determine the etiology of the spinal deformity is:

1) Bone scan
3) Magnetic resonance imaging of the brain and spinal cord
2) Lumbar puncture and cerebrospinal fluid analysis
5) Computerized tomography scan of the spine at the lumbosacral junction
4) Lateral flexion/extension radiographs of the cervical spine

Children with myelodysplasia are at risk for scoliosis, but a rapidly progressive curve should alert the physician to aggressively investigate the etiology. Causes include:

- Tethered cord
- Syringomyelia
- Shunt failure
- Progressive hydromyelia
- Arnold-Chiari malformation

All of these conditions can be readily diagnosed by a magnetic resonance imaging scan of the brain and spinal cord. Radiologic imaging such as radiographs, computerized tomography scans, or bone scans for bony lesions is rarely helpful. Cerebrospinal fluid analysis is unlikely to reveal an answer regarding scoliosis.

In the presence of a working ventriculoperitoneal shunt, the most likely etiology in this child is a tethered cord. Increased lumbar lordosis, back pain, or an increase in lower root level spasticity should alert the clinician to the possible presence of a tethered cord.Correct Answer: Magnetic resonance imaging of the brain and spinal cord

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2424. (286) Q6-401:

An 11-year-old girl presents with low back pain for 2 monthsâ duration. She is an elite gymnast and has missed 2 meets because of the pain. Physical exam reveals pain with hyperextension of the lumbar spine. Her neurological exam is normal. Radiographs of the lumbar spine, including oblique views, are normal. The recommendation is:

1) Rest, with slow return to training in 4 weeks
3) Magnetic resonance imaging of the spinal cord
2) Custom lumbosacral orthosis
5) Bone scan with single photon emission computed tomography imaging
4) Physical therapy exercises

Athletes involved in sports requiring repetitive hyperextension or rotation of the lumbar spine are susceptible to stress fractures of the pars interarticularis or spondylolysis. Two months of insidious back pain warrants a diagnostic work up, and radiographs may be nondiagnostic in the early period. A bone scan with single photon emission computed tomography will confirm the diagnosis in a patient with a history and physical findings of spondylolysis. Magnetic resonance imaging is rarely helpful in the diagnosis of this bony lesion, but it may be the next diagnostic modality if the bone scan was negative and the pain continued. Rest with immobilization is usually the first line of treatment for spondylolysis. In cases of refractory pain, controversy exists in the surgical management of this condition. Some authors favor repair of the lytic defect and others prefer a posterolateral fusion.Correct Answer: Bone scan with single photon emission computed tomography imaging

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2425. (287) Q6-402:

An 8-year-old girl presents with back pain and an abnormal gait. She walks with externally rotated feet and limited hip flexion. She has a palpable step-off at the lumbosacral junction and hamstring tightness. Radiographs of the lumbosacral spine demonstrate a dysplastic spondylolisthesis with a slip angle of 55Â° and slippage of 60% of L5 on S1. The recommended course of treatment is:

1) Posterolateral spinal fusion
3) Physical therapy
2) Epidural steroid injection
5) Observation with repeat radiographs in 6 months
4) Lumbosacral orthosis

Spondylolisthesis is the forward slipping of 1 vertebra on the next caudal vertebra. Spondylolisthesis in children can be classified into 2 types: isthmic and dysplastic. Isthmic spondylolisthesis is an entity in which there is a lesion in the pars interarticularis that permits forward slippage; the articular facets are normal. Dysplastic or congenital spondylolisthesis implies that there is a congenital deficiency in the L5-S1 facet that allows forward slipping. There is no defect or elongation in the pars.

Growing children, particularly females, with dysplastic spondylolisthesis are at risk for further progression. This patientâs abnormal gait is due to hamstring tightness, probably due to the lumbosacral instability and nerve root irritation. With a grade III slip, back pain, and an abnormal gait, this patient is a candidate for an in situ posterolateral spinal fusion. Use of instrumentation is controversial, especially because the long-term results of in situ noninstrumented fusions are superior.Correct Answer: Posterolateral spinal fusion

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2426. (288) Q6-403:

The following can be found in the examination and radiographs of a child with Scheuermann disease:

1) Schmorl nodes
3) Anterior wedging 3 or more vertebrae
2) Back pain
5) All of the above
4) Thoracic kyphosis

Scheuermann disease is increased thoracic kyphosis, usually rigid, occurring in adolescent males. The etiology is unknown, but has included theories dealing with avascular necrosis of the ring apophysis, growth plate abnormalities, biologic and mechanical causes. The classic definition is increased thoracic kyphosis (>45Â°) with 5Â° or more of anterior wedging at 3 sequential vertebrae. Other radiographic abnormalities include:

- Endplate irregularities
- Spondylolysis
- Compensatory lumbar hyperlordosis
- Schmorlâs nodes

Hamstring tightness and rigid thoracic kyphosis is noted on physical examination, and neurological function is normal.

Treatment consists of bracing in skeletally immature patients with a thoracolumbosacral orthosis, but many adolescent male patients are noncompliant with bracing. In the skeletally mature patient with pain and severe deformity (>65Â° of kyphosis), posterior spinal fusion with instrumentation is indicated. Occasionally, anterior diskectomy and interbody fusion with posterior fusion and instrumentation are required for severe deformity correction.

Postural kyphosis is also common in adolescent males, but the vertebral changes are not present, and the deformities are usually more supple. Treatment is hyperextension exercises.

Correct Answer: All of the above

2427. (289) Q6-404:

The natural history of which of the following spinal deformities in children carries with it the highest risk of paraplegia?

1) Congenital lordosis
3) Neuromuscular scoliosis
2) Congenital kyphosis
5) Postlaminectomy kyphosis
4) Idiopathic scoliosis

Congenital kyphosis, if left alone, is the most likely cause of paraplegia of all noninfectious spinal deformities. Defects of formation are more progressive than defects of segmentation, and paraplegia is common with defects that have an apex at T4-T9, the watershed area of spinal cord blood flow.

Treatment is usually surgical. There is no evidence of successful nonoperative treatment for congenital kyphosis. An early, limited posterior fusion, coupled with anterior growth, may result in a slow correction of the kyphosis. For kyphosis >55Â° in children older than 5 years of age, anterior and posterior spinal fusions are necessary. The tethering structures anteriorly must be released (anterior longitudinal ligament, annulus fibrosus) and distraction anteriorly is maintained by autogenous strut grafts. Posteriorly, compression instrumentation is required with fusion. If neurological compromise exists preoperatively, magnetic resonance imaging is necessary to delineate the area of compression so that an anterior cord decompression may be performed successfully.Correct Answer: Congenital kyphosis

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2428. (290) Q6-405:

A 12-year-old girl presents to the clinic with scoliosis detected by school screening. Her past medical history includes ophthalmologic observation for Lisch nodules of the iris. She has just started her menstrual periods. On physical exam, she has axillary freckles and normal neurological function. Standing radiographs of the spine illustrate a 32Â° right thoracic curve from T4 to T10 and rib pencilling. In the sagittal plane, she has a thoracic kyphosis of 30Â°. The most likely diagnosis is:

1) Adolescent idiopathic scoliosis
3) Neurofibromatosis-1 (NF-1)
2) Congenital kyphoscoliosis
5) Stickler disease
4) Neurofibromatosis-2 (NF-2)

Neurofibromatosis (von Recklinghausen disease) is an autosomal dominant disorder that affects connective tissue. The most common type is NF-1, and is associated with primary skeletal disorders such as scoliosis, cortical thinning and pseudarthrosis of the tibia. It is the result of an abnormality on chromosome 17, and is also associated with:

- CafÃ© au lait spots
- Neurofibromas
- Axillary or inguinal freckling
- Iris hamartomata (Lisch nodules)

Scoliosis in NF-1 can occur in 2 patterns. The first is similar to idiopathic scoliosis. The second, or dystrophic type is marked by short, sharper deformities, scalloping of the vertebral bodies, rib pencilling, enlarged foramina and severe apical vertebral body rotation. Some authors have demonstrated that curves characterized as idiopathic in childhood can take on dystrophic characteristics later in life and progress rapidly. Treatment is usually surgical.Correct Answer: Neurofibromatosis-1 (NF-1)

2429. (291) Q6-406:

A 3-year-old boy is referred by the pediatrician for neck stiffness. He has a mild hearing loss, but is otherwise healthy. On examination, his neck is rather short, and he has limitation of lateral rotation and bending, but flexion and extension are normal. There are no palpable bands in his neck. The anteroposterior and lateral cervical spine films ordered by the pediatrician show a congenital fusion of cervical vertebrae. The most likely diagnosis is:

1) Klippel-Feil syndrome
3) Congenital muscular torticollis
2) Fixed atlantoaxial rotatory subluxation
5) Axial neck pain
4) Arnold-Chiari malformation

The classic findings of Klippel-Feil syndrome include a short neck, low posterior hairline, and decreased neck range of motion, but <50% of patients have all 3 elements of the triad. The neck motion is limited due to congenital fusion of cervical vertebrae, and the severity of cervical spine involvement usually heralds associated manifestations. Facial asymmetry, cranial nerve palsy, deafness, cardiac anomalies, and synkinesia may be detected in the involved child.

It is important to differentiate congenital muscular torticollis from Klippel-Feil syndrome, because releasing the sternocleidomastoid muscle will not correct a bony deformity. Static lateral radiographs of the cervical spine may appear normal in young children, as ossification of abnormal levels has not yet occurred. Flexion/extension lateral radiographs are useful to define congenital fusions, and magnetic resonance imaging may further delineate the anatomy. It is also important to test neck motion in all planes, because flexion/extension may be normal if movement occurs through just a few spared levels.

Children with Klippel-Feil syndrome rarely develop neurological symptoms as a result of the congenital cervical fusion. Later in life, they may develop neurological impairment as a result of instability or degenerative disk disease.

Correct Answer: Klippel-Feil syndrome

2430. (292) Q6-407:

A 10-year-old boy with Down syndrome presents with his parents who have noticed that his endurance for walking seems to have decreased, and he seems clumsier. Your physical examination reveals generalized ligamentous laxity, but no other musculoskeletal abnormalities. His neurological examination is normal. His flexion/extension cervical spine radiographs are abnormal. The most likely pathophysiology is:

1) Os odontoideum
3) Klippel-Feil syndrome
2) Arnold-Chiari malformation
5) Transverse atlantal ligament insufficiency
4) Hypothyroidism

Children with Down syndrome (trisomy 21) have a higher incidence of hypothroidism, congenital heart disease, leukemia, and slipped capital femoral epiphysis. About 20% of children with Down syndrome develop atlantoaxial instability due to incompetence of the transverse atlantal ligament, and fortunately, most are asymptomatic.

Patients with Down syndrome should be screened for atlantoaxial instability with routine flexion/extension lateral cervical radiographs, especially prior to athletic participation. An atlanto-dens interval (ADI) of >5 mm should be treated with activity restriction in the absence of myelopathy. With symptoms of cervical myelopathy or an ADI >7 mm, an atlantoaxial arthrodesis is indicated.

Correct Answer: Transverse atlantal ligament insufficiency

2431. (293) Q6-408:

A 4-week-old female infant has congenital muscular torticollis. Which of the following is not associated with this condition?

1) Plagiocephaly
3) Developmental dysplasia of the hips
2) Cervical spine anomalies
5) Difficult delivery
4) Sternocleidomastoid muscle fibrosis

Congenital muscular torticollis is the most common cause of torticollis in the infant and young child. Usually, the children have a history of a breech or difficult delivery or primiparous birth. The exact etiology is unknown, but theories center around a compartment syndrome of the sternocleidomastoid muscle as a result of compression of soft tissues around the neck at the time of delivery. This results in fibrosis of the sternocleidomastoid muscle, tilting of the head to the ipsilateral side, and rotation of the head to the opposite side.

Congenital muscular torticollis is associated with developmental dysplasia of the hips in up to 20% of children, so a careful examination of hip stability is mandatory, with dynamic ultrasound, if necessary. Plagiocephaly or facial and skull deformities occur in progressive torticollis within the first year of life. The association of metatarsus adductus with congenital muscular torticollis is variable in the literature. Plain radiographs of the cervical spines of children with congenital muscular torticollis are always normal, with the exception of the head tilt and rotation.

Treatment initially includes stretching exercises and physical therapy early in life. Surgery (release of the muscle) is recommended if the torticollis persists after 1 year of age.Correct Answer: Cervical spine anomalies

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2432. (294) Q6-409:

A 13-year old boy presents to the emergency department with back pain of 5 daysâ duration. The pain is exacerbated by sitting or standing. He has a low-grade fever. He has pain on percussion of the lumbar spine. He has no tension signs. White blood cell count is 8000/mm^3 and the erythrocyte sedimentation rate is 40 mm/hr. Plain radiographs of the spine demonstrate a narrowed intervertebral space at L3-L4. The most likely diagnosis is:

1) Epidural abscess
3) Vertebral osteomyelitis
2) Diskitis
5) Iliopsoas abscess
4) Pott disease

The symptoms of diskitis are often vague and insidious. This hematogenous infection of the disk space acts differently than other musculoskeletal infections. The presentation is often that of a patient with low back pain or refusal to ambulate. Fever is usually low or absent. The white blood cell count is usually normal, but the erythrocyte sedimentation rate or C-reactive protein levels may be elevated. Blood cultures are frequently negative. Radiographs of the spine may be normal initially, but may show intervertebral disk space narrowing or end plate irregularities. Bone scan and magnetic resonance imaging are also helpful in the diagnosis.

Treatment is usually conservative, and outcomes are aided by the fact that this condition is usually self-limiting. Rest and immobilization provide symptomatic relief, and many authors favor intravenous antibiotics. After an initial response in 72 hours or less, the patient can be switched to oral antibiotics for 3 to 5 weeks. A biopsy is indicated if the patient does not improve quickly, or if a tumor or abscess formation is suspected.

Patients with vertebral osteomyelitis or abscesses are typically more ill-appearing, have high fevers and white blood cell counts, and a markedly elevated erythrocyte sedimentation rate. Furthermore, a patient with an epidural abscess may have neurological symptoms or a positive straight leg raising test, due to nerve root irritation or spinal cord compression.

Correct Answer: Diskitis

2433. (295) Q6-410:

An 11-year-old boy sustains a fall while jumping on a trampoline. He has moderate back pain, an L-5 radiculopathy, and weakness of the right extensor hallucis longus. Radiographs and a computerized tomography scan of the lumbar spine demonstrate a slipped vertebral apophysis. The recommended treatment is:

1) Laminectomy and excision of annulus and vertebral bony margin
3) Thoracolumbosacral orthosis
2) Bed rest
5) Spinal traction
4) Physical therapy

This patient has a slipped vertebral apophysis as a result of trauma. This is analagous to a Salter-Harris type II fracture. A portion of the apophysis and annulus slip posteriorly and may impinge on the exiting nerve root. These usually do not resolve spontaneously or improve with conservative therapy, and excision is indicated. The disk fragments and retropulsed bone must be removed from the canal with a laminectomy for exposure.Correct Answer: Laminectomy and excision of annulus and vertebral bony margin

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2434. (296) Q6-411:

Appropriate treatment of a nondisplaced Jefferson fracture is:

1) Hard cervical orthosis
3) Soft collar
2) Halo vest
5) Nerve treatment necessary
4) Posterior surgical stabilization

Fractures involving the C1 or atlas are generally caused by axial compression with either a flexion or extension force. Generally, fractures involving the C1 consist of multiple fragments. The classical Jefferson fracture is a 4-part fracture of the atlas and can be unstable. However, in this situation, a nondisplaced fracture represents a relatively stable injury. An open-mouth odontoid anteroposterior radiograph is frequently useful to evaluate unstable patterns. An unstable fracture typically has displacement of the lateral masses greater than 8 mm. If displacement of this amount occurs, generally, the transverse ligament has been disrupted and should be treated by halo vest immobilization. In this nondisplaced situation, a hard Philadelphia collar is the most appropriate form of treatment.Correct Answer: Hard cervical orthosis

2435. (297) Q6-412:

The American Spinal Injury Association has developed a classification of spinal cord injuries. Using this classification system, an Asia C injury is best described as:

1) Complete motor loss with incomplete sensation
3) Incomplete motor loss with some preservation of motor function with groups with less then grade 3 strength
2) Complete motor loss with complete sensation loss
5) Incomplete motor loss with 4+ strength and patchy sensation
4) Incomplete motor loss with normal bladder function

Asia C is an incomplete spinal cord injury with reservation of motor function with < grade 3 motor strength.Correct Answer: Incomplete motor loss with some preservation of motor function with groups with less then grade 3 strength

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2436. (298) Q6-413:

Which of the following incomplete spinal cord injury syndromes has the most potential for recovery:

1) Anterior cord syndrome
3) Brown-Sequard syndrome
2) Central cord syndrome
5) Pyramidal syndrome
4) Posterior cord syndrome

Brown-Sequard syndrome is described as ipsilateral loss of motor function and contralateral loss of pain and temperature sensation. This syndrome is caused by penetrating injuries. Generally < 90% of patient who have this injury will recover ambulation.Correct Answer: Brown-Sequard syndrome

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2437. (299) Q6-414:

A 6-year-old boy has neck pain and stiffness following an upper respiratory tract infection. He presented with his head tilted to the right and turned to the left 3 weeks ago, but a soft cervical collar has not been beneficial. There is no known history of trauma. A computerized tomography scan shows rotatory subluxation of C1 on C2. The next step in the treatment of this child is:

1) Observation
3) In situ C1-C2 fusion posteriorly
2) Open reduction and C1-C2 fusion through an anterior approach
5) Hard cervical collar
4) Cervical traction

This child has torticollis as sequelae of an upper respiratory infection (Grisel syndrome) and rotatory subluxation (fixation) of C1 on C2. Other causes of torticollis include congenital muscular torticollis, neurogenic causes, Sandifer syndrome, Klippel-Feil syndrome, juvenile rheumatoid arthritis, and trauma. The common thread is that all of the etiologies appear to weaken, through inflammation or force, the supporting soft tissue structures of the atlantoaxial articulation. The diagnosis is made by dynamic CT scan.

Fielding classified atlantoaxial rotatory subluxation into 4 types:

- Type I is a simple rotatory displacement without an anterior shift, and is the most common type in children.
- Type II is rotatory fixation with anterior displacement >3 to 5 mm, and is associated with a deficiency of the transverse ligament and unilateral displacement of one lateral mass of the atlas.
- Type III rotatory fixation there is anterior displacement >5 mm with bilateral displacement of the lateral mass with one side displaced more than the other. This is caused by a deficiency of both the transverse ligament and secondary ligament.
- Type IV is rotatory fixation with posterior displacement where the dens allows posterior shift of one or both of the lateral masses, and one shifting more than the other.

Types III and IV are rare but have potential for catastrophe and should be recognized to promptly initiate treatment.

Children with rotatory fixation of <1 week can be treated with a soft cervical collar and rest for 1 week. Most cases resolve, but close follow-up is necessary. If spontaneous reduction does not occur after 1-2 weeks, aggressive treatment is necessary. Inpatient halter traction with judicious use of muscle relaxants and analgesics is recommended. Halo traction is necessary for reduction of longer standing (2-4 weeks) subluxation. Surgery is indicated in cases of neurological compromise, failure to achieve closed reduction, long-standing deformity (3 months or more), or recurrence following closed treatment. A Gallie-type fusion posteriorly is favored.

Correct Answer: Cervical traction

2438. (673) Q6-928:

A 40-year-old victim of a car accident was complaining of anterior chest pain. An x-ray of the chest showed no widening of the mediastinum and absence of pneumothorax. Lateral CXR revealed a fractured sternum with the proximal part of the fracture displaced posteriorly. Which of the following is the next step in the management of this patient?

1) Arterial blood gas
3) Chest bandage for the fractured sternum
2) Aortogram
5) Lateral x-ray of the thoracic spine with the patient supine
4) Computed Tomography of the chest

N/ACorrect Answer: Lateral x-ray of the thoracic spine with the patient supine

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2439. (674) Q6-930:

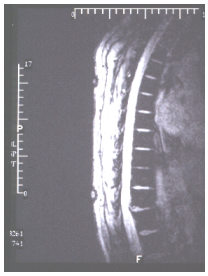

Figure 1 **Figure 2**

A 42-year-old male has a history of 6 months of pain in the lower thoracic region. Recently, the patient developed weakness in the right lower extremity, bladder and bowel movement. Plain x-rays were normal, but an magnetic resonance imaging (MRI) showed a posterolateral thoracic disk herniation at the level of T10-T11 (Slides 1 and 2). Which of the following is the best suggested treatment?

1) Bed rest
3) Laminectomy and decompression
2) Thoraco-lumbar orthosis
5) Thoracotomy, vertebractomy, strut graft and internal fixation
4) Diskectomy through thoracotomy or costotransverectomy

Conservative treatment should be considered for patients without major neurologic deficits. Posterior laminectomy and decompression provides inadequate exposure of the herniated Disk. Vertebractomy, strut bone graft and instrumentation are not necessary. Thoracotomy and costotransversectomy are commonly used for disk herniations at the levels of T4-T12.Correct Answer: Diskectomy through thoracotomy or costotransverectomy

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2440. (675) Q6-931:

The patient's clinical diagnosis is degenerative spondylolithesis. In what patient population is this condition most commonly symptomatic?

1) Pre-teen males
3) Males over 70-years-old
2) Females 40- to 70-years-old
4) Females 20- to 30-years-old

Degenerative spondylolithesis is most frequently symptomatic in the 40- to 70-year-old age range and is six times more common in females than in males. This population appears to have enough disc degeneration and motion to become symptomatic, whereas the older population tend to have acquired enough ankylosis at the level to prevent instability symptoms.Correct Answer: Females 40- to 70-years-old

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2441. (676) Q6-932:

The patient was diagnosed with spinal stenosis of the lumbosacral spine. In addition to educating the patient about his condition, the most appropriate initial treatment is:

1) Walking program
3) Lumbar traction
2) Nonsteroidal anti-inflammatory drugs
4) Spinal decompression and fusion

Initial treatment begins with patient education, a physical therapy regime (gentle conditioning exercises), judicious activity change, and sometimes spinal support with a corset or light-weight brace. Anti-inflammatory nonsteroidal drugs provide some relief of symptoms for many patients.Correct Answer: Nonsteroidal anti-inflammatory drugs

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2442. (956) Q6-1257:

The biggest contribution to lumbar lordosis:

1) Occurs mostly within the disk spaces
3) Is normally 70Â°
2) Occurs mostly within the vertebral bodies
5) Can be visualized best on an anteroposterior plain radiograph
4) Decreases with increasing age

Most of the lumbar lordosis occurs within the disk spaces and not within the vertebral bodies. Normal lumbar lordosis is between 30Â°to 50Â°, increases with age, and is best visualized on a lateral plain radiograph.Correct Answer: Occurs mostly within the disk spaces

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2443. (957) Q6-1258:

The superior aspect of the iliac crest often bisects this midline spinal structure:

1) L2/L3 disk space
3) L3/L4 disk space
2) L3 vertebral body
5) L5/S1 disk space
4) L4/L5 disk space

The L4/L5 intervertebral disk space is located by placing your fingers at the top of a patient's iliac crests, while allowing your thumbs to meet at the midline of the spine between the palpable L4 and L5 spinous processes.Correct Answer: L4/L5 disk space

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2444. (958) Q6-1259:

Certain physical examination maneuvers attempt to elicit tension signs. When used in the supine position, these maneuvers are designed to apply stretch or tension on the sciatic nerve and any inflamed nerve root against a herniated lumbar disk. Which of the following physical examination tests is not a tension sign maneuver:

1) Lasegue sign
3) Bowstring sign
2) McMurray sign
5) Contralateral straight-leg raising test
4) The sitting room test

McMurray sign is used to detect a torn meniscus in the knee and will have minimal effect on the sciatic nerve.

- Lasegue sign is the classic straight-leg raising test.
- The bowstring sign is a variation of the straight-leg raising test performed with the knee in a flexed position. Digital pressure is then applied over the popliteal space in an attempt to reproduce the tension sign.
- The sitting room test is performed with the patient in a sitting position. The hip remains flexed at 90Â° while the examiner extends the ipsilateral knee.
- The contralateral straight-leg raising test is performed in the same manner as the straight-leg raising test except the contralateral, or nonpainful, leg is raised.

Correct Answer: McMurray sign

2445. (959) Q6-1260:

When palpating the sacral triangle in the posterior aspect of a patient's lower back, if gaps are present between the spinous processes or no lumbar or sacral bony prominences are detected, this is suggestive of:

1) Spina bifida
3) Scoliosis
2) Gibbus deformity
4) Becs de perroquet

When palpating the lumbosacral area (sacral triangle), if palpable gaps are present between the spinous processes or there is an absence of lumbar and/or sacral bony prominences, this is suggestive of spina bifida.

- A Gibbus deformity is characterized by a sharp kyphosis and is often found in the thoracic spine.
- Scoliosis is identified by a lateral curvature of the spine
- A palpable "step-off" of one spinous process relative to the next would be suggestive of a spondylolisthesis.
- Becs de perroquet is a radiographic feature associated with tuberculosis of the lumbar spine in which bony bridges form across the sides of two adjacent vertebrae.

Correct Answer: Spina bifida

2446. (960) Q6-1261:

Which of the following is not a routinely used imaging technique for the evaluation of lumbar disk disease:

1) Myelography
3) Magnetic resonance imaging (MRI)
2) Computer tomography
5) Bone scan
4) Positron emission tomography (PET)

Positron emission tomography (PET) is a technique that measures brain activity through positron emission from radiolabled glucose.

- Myelography is an invasive procedure with radio-opaque dye placed into subarachnoid space. It aids in the detection of neural compressive lesions.
- Computer tomography alone offers better visualization of bony lesions, foraminal spinal stenosis, and lateral disk herniations when compared to plain myelography. Computer tomography is often combined with myelography.
- Magnetic resonance imaging (MRI) has an advantage over CAT because it detects soft tissue pathologies, including improved spinal cord imaging in the detection of intraspinal tumors. MRI also examines the entire spine.
- Bone scanning is a nonspecific but sensitive test. It is useful in detecting neoplastic, infectious, traumatic, and/or arthritic problems in the spine.

Correct Answer: Positron emission tomography (PET)

2447. (961) Q6-1262:

A 28-year-old woman complains of pain and numbness in her lower legs bilaterally for approximately 2 months following strenuous moving of furniture. She now states that she has not voided in the past 48 hours and that her abdomen area is markedly distended. Which is the most likely causative lesion of the patient's symptoms:

1) Cauda equina syndrome
3) Posterolateral disk herniation
2) Far-lateral disk herniation
5) Muscle spasms of the lower back
4) Spinal stenosis

This patient's symptoms are most consistent with cauda equina syndrome. This surgical emergency can present with bowel or bladder dysfunction, and bilateral lower extremity symptoms are also often present.Correct Answer: Cauda equina syndrome

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2448. (962) Q6-1263:

A 28-year-old woman complains of pain and numbness in her lower legs bilaterally for approximately 2 months following strenuous moving of furniture. She now states that she has not voided in the past 48 hours and that her abdomen area is markedly distended. What diagnostic test must be performed in order to support the suspected diagnosis:

1) Voiding cystourethrogram
3) Posteroanterior and lateral plain radiographs of the lumbar spine
2) Magnetic resonance imaging of the lumbosacral spine
5) Electromyography of the lower extremities
4) Spinal puncture to rule out infection

Based on history and physical examination, the suspected diagnosis is cauda equina syndrome. This potential surgical emergency requires immediate spinal imaging. A magnetic resonance imaging of the lumbosacral spine is the most appropriate test.Correct Answer: Magnetic resonance imaging of the lumbosacral spine

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2449. (963) Q6-1264:

On physical examination, the umbilicus is a superficial landmark for the bifurcation of the aorta into the common iliac arteries and overlies this disk space:

1) L1/L2
3) L3/L4
2) L2/L3
5) L5/S1
4) L4/L5

The umbilicus is a superficial landmark that often lies over the anterior L3/L4 disk space, which is the location of the aortic bifurcation into the common iliac arteries. Below this arterial division, in lean individuals, one can palpate the anterior bodies of L4, L5, and S1.Correct Answer: L3/L4

2450. (964) Q6-1266:

Slide 1

A 35-year-old woman has been complaining of severe unrelenting mid to low back pain for the past 5 months. Conservative management, consisting of bed rest and nonsteroidal anti-inflammatory drugs (NSAIDs), has not decreased the intensity of her symptoms. She immigrated to the United States from Vietnam 6 months ago. Based on the sagittal magnetic resonance image below, the next step in her management is:

1) Antibiotics with gram-positive coverage
3) Biopsy of the lesion to obtain a specimen for pathology
2) Surgical decompression and reconstruction
5) Physical therapy for low back strengthening
4) Continued conservative management and observation

It is prudent to determine the underlying etiology of this lesion. Tuberculous spondylitis is increasing in frequency and must be suspected in people who emigrate from countries where tuberculosis is endemic. A biopsy of the region must be obtained in order to make the diagnosis of tuberculosis accurately or any other infectious and noninfectious causative agent in order to determine proper management.Correct Answer: Biopsy of the lesion to obtain a specimen for pathology

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2451. (965) Q6-1268:

What is the most common sequence of steps performed during a midline open disectomy in the treatment and excision of a herniated posterolateral lumbar disk:

1) The paraspinal musculature is stripped from the lamina of the vertebra, the ligamentum flavum is excised, portions of the superior and inferior lamina are removed, the nerve root and dural sac is retracted, and the disk herniation is excised.
3) The ligamentum flavum is excised, the paraspinal musculature is stripped from the lamina of the vertebra, the nerve root and dural sac is retracted, portions of the superior and inferior lamina are removed, and the disk herniation is excised.
2) The ligamentum flavum is excised, the paraspinal musculature is stripped from the lamina of the vertebra, portions of the superior and inferior lamina are removed, the nerve root and dural sac is retracted, and the disk herniation is excised.
5) Ligamentum flavum is excised, the disk herniation is excised the paraspinal musculature is stripped from the lamina of the vertebra, the nerve root and dural sac is retracted, and portions of the superior and inferior lamina are removed.
4) The paraspinal musculature is stripped from the lamina of the vertebra, the disk herniation is excised, the ligamentum flavum is excised, the nerve root and dural sac is retracted, and portions of the superior and inferior lamina are removed.

The traditional surgery for the excision of a herniated posterolateral lumbar disk is by means of a midline incision. This procedure is then performed in a stepwise fashion: The paraspinal musculature is stripped from the lamina of the vertebra; the ligamentum flavum is then excised; portions of the superior and inferior lamina are removed; and the nerve root and dural sac are identified and carefully retracted. This is followed by excision of the herniated disk material and wound closure.Correct Answer: The paraspinal musculature is stripped from the lamina of the vertebra, the ligamentum flavum is excised, portions of the superior and inferior lamina are removed, the nerve root and dural sac is retracted, and the disk herniation is excised.

2452. (966) Q6-1269:

On physical examination, a patient with a weak extensor hallucis longus muscle might be expected to have a far-lateral disk herniation at what level in the spine:

1) L2/L3
3) L4/L5
2) L3/L4
5) S1/S2
4) L5/S1

A far-lateral disk herniation in the lumbar spine often compromises the more proximal, or exiting, nerve root and not the more distal, or traversing, nerve root most typically affected in a posterolateral disk herniation. Therefore, a far-lateral disk herniation at the L5 - S1 level could irritate the L5 nerve root, which would affect the extensor hallucis longus muscle.Correct Answer: L5/S1

2453. (968) Q6-1271:

One traditional surgery performed for the treatment of a symptomatic posterolateral lumbar disk herniation is a partial laminectomy and lumbar disk excision by means of a midline incision. What is the long-term (>2 years) success rate for relief of both leg and low back pain, respectively:

1) 80% and 93%
3) 93% for both
2) 93% and 80%
5) 55% and 65%
4) 80% for both

The success rate following a partial laminectomy and lumbar disk excision for a posterolateral herniated disk for relief of both leg and low back pain is predictable at 93% and 80%, respectively.Correct Answer: 93% and 80%

2454. (969) Q6-1272:

A 38-year-old man injured his neck and spinal cord 6 months ago as a result of a motorcycle accident. He is now a C6 quadriplegic. He wants to know how his sexual function will be affected by his condition. The patient should be informed that:

1) He should be able to obtain normal erections and ejaculation function.
3) With external stimulation, a reflex erection is possible but normal ejaculation is not.
2) No erections or ejaculation function will exist.
5) He has a low probability of being sterile because precise control of thermal regulation of the testes is usually retained.
4) Normal erections and ejaculations with low sperm counts are possible.

With this type of spinal cord injury, it is possible to have an erection with external stimulation; however, ejaculation would have to be facilitated by electrical stimulation or vibratory means.Correct Answer: With external stimulation, a reflex erection is possible but normal ejaculation is not.

2455. (970) Q6-1273:

When testing the range of motion in the lumbar spine, which maneuver involves stretching of the interspinous and supraspinous ligaments, ligamentum flavum, and posterior longitudinal ligament while relaxing the anterior longitudinal ligament:

1) Flexion
3) Lateral bending
2) Extension
5) None of the above
4) Lateral bending

Flexion of the lumbar spine creates stretching or tension of the posterior spinal structures including the interspinous and supraspinous ligaments, ligamentum flavum, and posterior longitudinal ligament. Flexion also allows relaxation of the anterior longitudinal ligament. This is often elicited by having a patient bend forward in attempt to touch the floor with the fingertips. If the patient cannot touch the floor, the distance from the floor to fingertips is measured in fingerbreadths or inches.Correct Answer: Flexion

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2456. (971) Q6-1275:

Slide 1

A 22-year-old woman sustained an injury to her low back 1 year ago while playing rugby. She now complains of excruciating low back pain with numbness and tingling into her left buttock. This pain is affecting her daily living activities. The patient underwent 6 months of conservative management consisting of restriction of activities, physical therapy, and anti-inflammatory medication with little relief. Based on the image below, the next appropriate step in the management of this patient is:

1) Continued conservative management
3) Laminectomy at the L2/L3 level
2) Posterolateral fusion at the L5/S1 level with bone graft
5) Diskectomy at the L3/L4 level
4) Laminectomy at the L3/L4 level

The patient has an L5/S1 spondylysis with a grade 1 spondylolisthesis. This patient has undergone a sufficient attempt at conservative management with continued unrelenting low back pain. The next most appropriate step in the management of this condition is a posterolateral fusion at the L5/S1 level with autologous bone graft.Correct Answer: Posterolateral fusion at the L5/S1 level with bone graft

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2457. (972) Q6-1276:

When performing a neurological examination, if a surgeon has a patient resist thigh adduction against resistance, the surgeon is testing which nerve(s):

1) Segmental nerves from T1-L1
3) Obturator nerve
2) Femoral nerve
5) Segmental nerves from L5-S1
4) Sciatic nerve

The obturator nerve innervates most of the hip adductor group, which consists of neurologic levels L2, L3, and L4.Correct Answer: Obturator nerve

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2458. (973) Q6-1277:

A 72-year-old man comes to the office complaining of low back and thigh pain that has been progressively getting worse over the years. The pain now bothers him during weather changes. The patient tells you that his pain is worse with standing and walking for long periods. However, leaning forward and sitting alleviates his discomfort. The patient denies any bladder or bowel complaints. This patient most likely has:

1) A herniated lumbar disk
3) Lumbar spinal stenosis
2) Cauda equina syndrome
5) Vascular insufficiency
4) Spinal cord tumor

This patient is presenting with the hallmark symptoms of lumbar spinal stenosis, which consists of increased back and thigh pain with walking or standing with relief of the symptoms by leaning forward or sitting down. This patient denies any bladder or bowel dysfunction that makes cauda equina syndrome unlikely. Although urinary dysfunction is uncommon in spinal stenosis, it can occur in approximately 3% to 4% of cases.Correct Answer: Lumbar spinal stenosis

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2459. (974) Q6-1278:

A positive straight-leg raise sign:

1) Occurs when the obturator nerve is stretched
3) Is important in predicting a successful outcome if surgery is performed to excise the herniated fragment
2) Is always associated with a history of trauma or injury
5) Is not sensitive in detecting a lumbar disk herniation
4) Is a specific test to detect a lumbar disk herniation

A positive straight-leg raise sign occurs when the sciatic nerve is placed under tension or is stretched reproducing a radiculopathy. It is also suggestive of inflammation around the nerve root, hence it is a good predictor of the successful relief of symptoms from surgical decompression. Additionally, a positive straight-leg raise sign is a relatively sensitive test for detecting a lumbar disk herniation, but it is not specific. Because the sign is not specific, it does not necessarily correspond to trauma or injury.Correct Answer: Is important in predicting a successful outcome if surgery is performed to excise the herniated fragment

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2460. (975) Q6-1279:

What physical examination maneuvers listed below check the status of the L4 neurologic level:

1) Sensation on the lateral side of the ankle, the patellar tendon reflex, and plantar eversion
3) Sensation on the lateral side of the ankle, the Achilles tendon reflex, and plantar inversion
2) Sensation on the lateral side of the ankle, the patellar tendon reflex, and plantar inversion
5) Sensation on the medial side of the ankle, the patellar tendon reflex, and plantar inversion
4) Sensation on the medial side of the ankle, the Achilles tendon reflex, and plantar inversion

Sensation on the medial side of the ankle, the patellar tendon reflex, and plantar inversion are associated with the L4 neurologic level. Sensation on the lateral side of the ankle and the Achilles tendon reflex are associated with the S1 neurologic level.Correct Answer: Sensation on the medial side of the ankle, the patellar tendon reflex, and plantar inversion

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2461. (976) Q6-1280:

In describing idiopathic scoliosis, there are several terms given to curve patterns on radiographs to describe the specific type of spinal deformity present. Which term best describes an area of the spine with a lateral curve that lacks normal flexibility noted radiographically by its failure to demonstrate segmental mobility or correction on supine side-bending radiographs:

1) Primary curve
3) Major curve
2) Compensatory curve
5) Structural curve
4) Minor curve

The above question is describing a structural (nonflexible) curve.

- A primary curve is the earliest of several curves that may eventually develop.
- The term major curve is used to designate the largest structural curve.
- The minor curve refers to the smallest structural curve and is usually more flexible than the major curve.
- The compensatory curve is located above or below a major curve to attempt to maintain normal body alignment.

Correct Answer: Structural curve

2462. (977) Q6-1281:

When performing a physical examination, if running the pointed edge of a reflex hammer along the crest of a patient's tibia causes extension of the great toe while the remaining toes splay or plantarflex, this finding would indicate:

1) A Babinski reflex is present
3) A Positive Oppenheim test
2) A Babinski reflex is absent
5) None of the above
4) A Negative Oppenheim test

An Oppenheim test is considered positive when running a pointed object along a patient's tibial crest elicits splaying or plantarflexion of the smaller toes with great toe extension. An Oppenheim test is considered negative when this reaction is not present.

- A Babinski reflex is present when running a pointed object across the plantar surface of a patient's foot elicits splaying or plantarflexion of the toes with extension of the great toe. A Babinski reflex is considered absent when the toes either do not move or all five toes flex and/or bunch up in response to the stimulus.

Correct Answer: A Positive Oppenheim test

2463. (978) Q6-1282:

When trying to distinguish hamstring tightness/discomfort from sciatic pain/radiculopathy, surgeons can perform a straight-leg raise test on the affected side until the point at which the patient develops discomfort. This is followed by slightly lowering the affected extremity. While holding the patient's leg in this position, what maneuver could be performed in order to help reproduce true sciatic pain:

1) Rotate the patient's foot medially 10Â°
3) Plantarflex the patient's foot
2) Rotate the patient's foot laterally 10Â°
5) Perform a Babinski test
4) Dorsiflex the patient's foot

Dorsiflexion of the foot, known as Braggard test, adds additional tension or stretch to the sciatic nerve and may help reproduce the sciatic pain/radiculopathy.Correct Answer: Dorsiflex the patient's foot

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2464. (979) Q6-1283:

Beevor sign is a physical examination maneuver that tests the integrity of the rectus abdominus muscles that are segmentally innervated by the anterior primary divisions of the T5-T12/L1 nerve roots. When performing this test, the patient is asked to perform a partial sit-up. A positive Beevor sign is indicated by:

1) Pain in the abdominal musculature
3) The absence of any deviation of the umbilicus
2) Simultaneous raising both lower extremities
5) Pain radiating down both lower extremities
4) The presence of umbilical deviation

When performing a sit-up, umbilical deviation due to abnormal contraction of the rectus musculature indicates either a partial or complete loss of segmental innervation to a portion of the rectus abdominus and/or paraspinal musculature. It is frequently seen in patients with certain neurological disorders such as meningomyelocele and poliomyelitis.Correct Answer: The presence of umbilical deviation

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2465. (980) Q6-1284:

Which anatomic structure(s) may be the cause of referred pain to the lumbar spine region:

1) The hip
3) The pelvis
2) The rectum
5) The hip, the pelvis, and the rectum
4) Both the hip and the pelvis

The hip, rectum, and pelvis may refer pain to the lumbar spine region. In order to perform a complete physical examination, a rectal exam is recommended on all patients with pain in the lumbar spine region.Correct Answer: The hip, the pelvis, and the rectum

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2466. (981) Q6-1285:

The following nonoperative treatments have not been proven effective in the early acute stage (2 weeks to 3 months) of low back pain:

1) Nonsteroidal anti-inflammatory drugs
3) Anesthetic/corticosteriod injections into the epidural space
2) Bed rest
5) Intraspinal anesthetic/corticosteriod injections
4) Intrathecal anesthetic/corticosteriod injections

- Nonsteroidal anti-inflammatory drugs have been shown effective and are frequently used during the acute phase of low back pain. Their main effect is to alleviate soft tissue inflammation that is often present in the early phase.
- Patient questionnaires have identified bed rest as among the most frequently prescribed treatments for lower back pain. It has been shown that bed rest results in reduced intradiskal pressure that occurs in the supine position.
- Anesthetic/corticosteriod injections are widely advocated for the treatment of low back pain and can be administered along nerve roots, into the sacroiliac joints, intervertebral disks, paraspinal soft tissues, and the epidural space or intrathecally for many conditions. However, there is no evidence that intraspinal steroids have an effective role in the acute management of low back pain.

Correct Answer: Intraspinal anesthetic/corticosteriod injections

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2467. (982) Q6-1286:

A 32-year-old woman is diagnosed on magnetic resonance imaging with a far-lateral disk herniation at the L3/L4 level causing radiating right lower extremity discomfort across the anterior aspect of her knee with no motor or reflex abnormalities. Which of the following nerve roots is most likely affected:

1) L1
3) L3
2) L2
5) L5
4) L4

A far-lateral or foraminal disk herniation often affects the exiting or more proximal nerve root. The traversing or more distal nerve root is typically affected from a posterolateral disk herniation. In this case, the patient has a far-lateral disk herniation at the L3/L4 level resulting in L3 nerve root symptomatology.Correct Answer: L3

2468. (983) Q6-1287:

An 18-year-old man comes to the office with a grade IV isthmic spondylolisthesis and severe left lower extremity discomfort. Which imaging study would best help identify the site of potential nerve root compression:

1) Computed tomography scan
3) Plain myelography
2) Magnetic resonance imaging (MRI) scan
5) Positron emission tomography (PET)
4) Bone scan

An MRI scan would be the imaging study of choice to best identify the site of nerve root compression because it provides parasagittal views that can help determine the degree of narrowing of the neural foramina.

- Plain myelography may not accurately identify lateral recess compression.
- A CT scan would produce images perpendicular to the plane of nerve root compression.
- Bone scan and PET scan would be of little or no help in identifying nerve root compression.

Correct Answer: Magnetic resonance imaging (MRI) scan

2469. (984) Q6-1288:

Some of the more common risk factors that could predispose a person to developing low back pain are listed below. Which risk factor has not been implicated:

1) Occupations requiring the use of jackhammers
3) Cigarette or other tobacco consumption
2) Being above normal bodyweight
5) Occupations requiring the frequent operation of motor vehicles
4) Female gender

Being female has not been implicated as a risk factor in the development of low back pain. Occupations that require heavy lifting, the use of jackhammers, and operating motor vehicles, as well as the usage of tobacco products and being overweight have all been associated with a higher incidence of developing low back pain.Correct Answer: Female gender

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2470. (985) Q6-1289:

When considering surgical intervention in the management of low back pain, it is crucial to try and identify the possible offending agent or pain generator. Based on awake anatomical stimulation studies, what percentage of patients should report significant discomfort when a nerve root is either compressed or stretched in an attempt to elicit pain:

1) 99%
3) 40%
2) 60%
5) 1%
4) 20%

Studies have reported on diskectomies in awake patients performed under local anesthesia. Anatomic spinal structures were stimulated prior to additional local anesthesia placed into these deeper areas and patients were asked to report any pain. Compression or stretching of nerve roots caused significant pain 100% of the time. Stimulation of the posterior dura caused significant pain only 1% of the time.Correct Answer: 99%

2471. (986) Q6-1291:

Which disorder does not represent a rheumatologic/inflammatory condition associated with causing low back pain:

1) Rheumatoid arthritis
3) Psoriatic arthritis
2) Reiter syndrome
5) Osteoarthritis
4) Ankylosing spondylitis

Although osteoarthritis is the most common arthritic disorder associated with low back pain, it is not a rheumatologic condition. Rheumatoid arthritis, Reiter syndrome, psoriatic arthritis, and ankylosing spondylitis are all rheumatologic or inflammatory conditions associated with the development of low back pain.Correct Answer: Osteoarthritis

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2472. (987) Q6-1292:

A 57-year-old man with known lung cancer and metastatic disease complains of increasing low back pain. How often is the lumbar spine involved when a patient has known spinal metastasis:

1) 5%
3) 50%
2) 15%
5) 99%
4) 85%

In 85 % of patients with metastatic disease to the spine, the lumbar region vertebral body is involved. If operable, the vertebral body lesion can be managed via an anterior approach with a corpectomy, as opposed to a posterior approach with laminectomy and removal of all involved posterior elements (if they are involved).Correct Answer: 85%

2473. (988) Q6-1293:

A 32-year-old man develops left lower extremity discomfort following a basketball game. A magnetic resonance image of the lumbar spine reveals a posterolateral disk herniation at the level of L4/L5. All of the following conditions could be associated with this except:

1) Decreased strength in the hip abductors
3) Numbness in the lateral aspect of the leg
2) Decreased strength in the extensor hallucis longus muscle
5) Pain in the dorsum of the foot
4) Decreased strength in plantarflexion of the foot

Decreased strength in the hip abductors and in the extensor hallucis longus muscle along with numbness in the lateral aspect of the leg and pain in the dorsum of the foot can all be associated with a herniation at the L4/L5 level affecting the L5 nerve root. Decreased strength in plantarflexion of the foot is present when the S1 nerve root is involved, such as with a disk herniation at the L5/S1 level.Correct Answer: Decreased strength in plantarflexion of the foot

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2474. (989) Q6-1294:

A 43-year-old man develops pain radiating down his left leg from a far-lateral disk herniation at the L5/S1 level. Which is the most likely nerve root contributing to his discomfort:

1) L2
3) L4
2) L3
5) S1
4) L5

Typically, for a posterolateral disk herniation, the traversing or more distal nerve root is often involved. With a far-lateral disk herniation (as in this case), the exiting nerve root is usually involved. In this case, it would be the L5 nerve root.Correct Answer: L5

2475. (990) Q6-1296:

Which orthopedic test, designed to apply tension to the spinal cord producing pain, involves having the patient lie supine while the examiner flexes the patient's head to his chest:

1) Kernig sign
3) Milgram test
2) Hoover test
5) Gaenslen test
4) Naffziger test

The Kernig test involves the patient lying supine while the examiner forcibly flexes the head to the chest applying tension to the spinal cord. The test is positive if pain is elicited and indicates meningeal irritation in conditions such as meningitis.

- The Hoover test can help identify a patient who is malingering. This test involves having the patient lie supine with the examiner's hands placed under both of the patient's heels. The patient is asked to lift the affected leg. If a true effort is made, the examiner should feel downward pressure in the patient's opposite foot as he attempts to lift the affected leg. If no downward pressure is felt, the patient purposely may not be trying and might be malingering.
- The Milgram test may be used in conditions with suspected intrathecal pathology. While lying supine, the patient is asked to perform bilateral straight leg lifts. If the patient can sustain his feet 2 inches off the ground for more 30 seconds, intrathecal pathology is less likely.
- The Naffziger test is designed to increase intrathecal pressure and thus pain by compressing the jugular veins.
- The Gaenslen test is used to determine sacroiliac joint pathology.

Correct Answer: Kernig sign

2476. (991) Q6-1297:

A 52-year-old man sustained an L1 burst fracture after falling from a ladder 3 weeks ago. He was found neurologically intact after initial examination. He has been treated with conservative management since the accident, but he now complains of an inability to void along with numbness and tingling in both of his legs. Computed tomography scan shows worsening conus compression. On physical examination, you discover that he has weak anal sphincter tone. Your next step in the treatment of this patient should be:

1) Anterior decompression and fusion with grafting with or without instrumentation
3) Laminectomy
2) High-dose steroids
5) Continue conservative management with follow-up in 1 month
4) Posterior fusion with instrumentation

This patient has deteriorating neurological findings involving the cauda equina; therefore, surgical decompression is indicated. An anterior approach will directly decompress the neural structures.

- Performing a laminectomy alone is actually contraindicated as it may increase potential spinal instability.
- A posterior approach to achieve a fusion with instrumentation may not fully decompress the neural structures, although this is somewhat controversial.

Correct Answer: Anterior decompression and fusion with grafting with or without instrumentation

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2477. (992) Q6-1298:

A 27-year-old man comes in for examination. He complains of worsening pain in his lower back. He states that the pain started 4 days ago after lifting a heavy box. The patient's neurological exam is completely nonfocal. The initial management of this patient should include:

1) Computed tomography scan of the lumbar spine with contrast
3) Magnetic resonance image of the lumber spine
2) Epidural steroid injection
5) Computed tomography scan of the lumbar spine without contrast
4) Bed rest of short duration along with nonsteroidal anti-inflammatory medications

This patient's neurological exam is normal and his injury was recent; this is most likely a soft tissue injury to his low back. Due to the patient's age and the fact that this is most likely not a serious injury, an initial conservative approach would be most appropriate. Epidural steroids or a selective nerve root block would be indicated if this patient developed worsening low back complaints or radicular pain in association with his low back pain.Correct Answer: Bed rest of short duration along with nonsteroidal anti-inflammatory medications

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2478. (993) Q6-1299:

When trying to distinguish sciatic radicular pain from pain following a hamstring strain, it is important to know that pain from a hamstring strain usually only involves the posterior aspect of thigh. Sciatic nerve pain may also be associated with:

1) Pain radiating down the leg and into the foot
3) Pain in the opposite leg
2) Low back pain
5) Pain radiating down the leg and into the foot, pain in the opposite leg, and low back pain
4) Pain radiating down the leg and into the foot, and pain in the opposite leg

Sciatic pain can involve all of the above complaints including radicular pain extending down the leg, low back pain, and pain into the opposite leg.Correct Answer: Pain radiating down the leg and into the foot, pain in the opposite leg, and low back pain

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2479. (994) Q6-1300:

A 42-year-old man sustained a twisting injury to his low back 5 months ago. Since the injury, he has persistent low back pain that radiates into his right thigh and down to his posterior calf. The patient underwent a magnetic resonance imaging of his lumbar spine revealing a small posterolateral lumbar disk herniation at the L4L5 level. Over the past month, the patient states that his leg pain has been getting progressively better and has almost disappeared over the past week with the use of nonsteroidal anti-inflammatory medications and occasional bed rest. The next step in the management of this patient should be:

1) A lumbar computed tomography scan
3) Surgical excision of the herniated disk
2) Repeat magnetic resonance image
5) Epidural steroid injection
4) Continued conservative management

The patient has shown continued improvement of his symptoms including the leg pain with conservative treatment. Epidural steroids would be indicated if this patient had continued or worsening leg pain and/or low back pain.Correct Answer: Continued conservative management

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2480. (995) Q6-1301:

Slide 1

This radiograph shows a grade I spondylolisthesis of L5 on S1. This is due to a defect in what anatomical area:

1) Superior articular process
3) Pars interarticularis
2) Inferior articular process
5) Lamina
4) Pedicle

The anatomical region involved in a spondylolisthesis is the pars interarticularis that is located between the superior and inferior articular processes and is a high stress area of relatively thinner bone.Correct Answer: Pars interarticularis

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2481. (996) Q6-1302:

Slide 1

A 16-year-old football lineman develops unrelenting low back pain for the past 3 months. Based on the magnetic resonance image shown, the next step in the management of this patient is:

1) Fusion in situ
3) Excision of a herniated disk
2) Epidural injection therapy
5) Observation
4) Restriction of the exacerbating activity

This patient has a grade I-II spondylolisthesis of L5 on S1. The initial management should include restriction of physical activity. Once the symptoms abate, the athlete can return to the sport. If symptoms return, other interventions are indicated including possible brace wear.Correct Answer: Restriction of the exacerbating activity

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2482. (997) Q6-1304:

Slide 1

A 50-year-old woman with 3 months of low back pain recently discovers a hard, painless lump in her breast. Due to the back discomfort, she undergoes plain radiography and subsequently a computed tomography scan (below). The most likely diagnosis is:

1) Osteomyelitis
3) Fracture
2) Osteoid osteoma
5) Metastatic disease
4) Herniated nucleus pulposis

The computed tomography scan reveals a destructive lesion involving the vertebral body extending into the pedicle in a patient with a suspected breast malignancy. This is a metastatic lesion until proven otherwise. This patient needs a thorough evaluation of her breast lesion, as well as her spine lesion, including biopsies. An osteoid osteoma is seen in a younger population and is seen on a computed tomography scan as a sclerotic round lesion.Correct Answer: Metastatic disease

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2483. (998) Q6-1305:

Slide 1

A 45-year-old construction worker with long standing low back pain now notices bilateral thigh and lower extremity discomfort for the past 6 months. He has undergone conservative treatment with little success including injection therapy. He cannot perform his work duties. Based on the lateral radiograph shown below, the next step in the management of the patient should consist of:

1) Laminectomy
3) Posterolateral fusion in situ without instrumentation
2) Continued conservative treatment
5) Decompression and posterolateral fusion in situ with instrumentation.
4) Diskectomy

This patient has an isthmic L4L5 spondylolisthesis with accompanied neuroforaminal stenosis. He already failed conservative management and would benefit from operative intervention. This should consist of a decompressive procedure to alleviate his lower extremity symptomatology along with a fusion procedure of the L4-L5 level due to the listhesis. If he undergoes a laminectomy alone, he may develop increased low back pain in the future.Correct Answer: Decompression and posterolateral fusion in situ with instrumentation.

2484. (1202) Q6-1568:

A 35-year-old woman presents with severe back pain. Radiographic evaluation reveals a thoracic curve of 70Â° and a loss of thoracic kyphosis. Surgery is recommended to correct the deformity. Which of the following tests must be ordered as part of the preoperative evaluation:

1) Electrocardiogram (ECG)
3) Electromyelogram (EMG)
2) Pulmonary function tests
5) Somatosensory evoked potentials (SSEP)
4) Chest radiograph

Thoracic curves greater than 65Â° may affect pulmonary function, especially when they are combined with thoracic lordosis. This patient displays a thoracic curve of 70Â° and a loss of the normal thoracic kyphosis; therefore, pulmonary function tests are part of the routine evaluation.Correct Answer: Pulmonary function tests

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2485. (1203) Q6-1569:

A calcified thoracic disk in the spinal canal is pathognomonic for:

1) Scheuermann disease
3) Thoracic disk herniation
2) Ankylosing spondylitis
5) Infection
4) Vertebral wedging

Plain radiographs of the spine are helpful in the diagnosis of disk herniation only if they demonstrate disk calcification. However, the calcified disk is not always the disk that is herniated, but it suggests the diagnosis. Detection of a calcified disk on radiograph in the canal is pathognomonic of herniation.Correct Answer: Thoracic disk herniation

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2486. (1204) Q6-1570:

Surgical treatment of thoracic disk herniation by a laminectomy is contraindicated because this procedure is associated with which of the following:

1) Incomplete relief of symptoms
3) Destabilization of the spine
2) High incidence of neurologic damage
5) High incidence of post-laminectomy kyphosis
4) High incidence of recurrence

There is a high incidence of spinal cord injury associated with thoracic disks removed by laminectomy. The advent of alternative procedures, such as costotransversectomy and transthoracic decompression, has led to a decrease in spinal cord injury admissions. Also, patients who do not improve after laminectomy are less likely to be helped by later anterior decompression.Correct Answer: High incidence of neurologic damage

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2487. (1205) Q6-1571:

The most common presenting symptom of a patient with a thoracic disk herniation is:

1) Anterior band-like chest pain
3) Epigastric pain
2) Intrascapular pain
5) Lower extremity weakness
4) Lower extremity pain

Brown et al reported on a series of 55 patients initially treated with conservative management. Anterior band-like chest pain occurred in 67% of his patients. Lower extremity complaints accounted for 20% and ranged from weakness (16%) to parasthesias (4%).Correct Answer: Anterior band-like chest pain

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2488. (1206) Q6-1572:

The natural history of an asymptomatic thoracic disk herniation is:

1) Rapid progression to a symptomatic thoracic disk herniation
3) To remain asymptomatic
2) A slow progression to a symptomatic thoracic disk herniation
5) To completely resorb and progress to a degenerative disk
4) To completely resorb and remain asymptomatic

The natural history of an asymptomatic thoracic disk herniation is to remain asymptomatic and exhibit little change in size. In a series of 48 asymptomatic thoracic disk herniations, Wood found that all disks remained asymptomatic at follow-up with little fluctuation in size of the disk.Correct Answer: To remain asymptomatic

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2489. (1207) Q6-1573:

A 48-year-old man presents with acute onset of unilateral, anterior band-like chest pain after lifting heavy machinery at work. The history and physical examination and the magnetic resonance image confirm a T9-T10 thoracic disk herniation. The best initial treatment for this patient is:

1) Bed rest and traction for 6 weeks
3) Activity modification and physical therapy
2) Costotransversectomy to remove the T9-T10 disk herniation
5) Laminectomy and decompression of the disk
4) Transthoracic decompression of the disk

Brown et al retrospectively reviewed the natural history of symptomatic thoracic disk herniations and found 77% of patients did well with nonsurgical management. The patients returned to their previous level of activity following activity modification and physical therapy.Correct Answer: Activity modification and physical therapy

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2490. (1208) Q6-1574:

The most common site of a thoracic disk herniation requiring surgery is from levels:

1) T1-T4
3) T8-T11
2) T4-T7
5) T12-L1
4) T11-T12

T8-T11 is the most common site of disk herniation that requires surgery. A review of 71 patients with 82 thoracic disk herniations undergoing surgery found that 66% of disks were between T8-T11. The most common disk level was T9-T10, which represented 26% of the herniations.Correct Answer: T8-T11

2491. (1209) Q6-1575:

The most common location for a thoracic disk herniation is:

1) Central
3) Centrolateral
2) Lateral
5) Mediolateral
4) Medial

The most common locations for a thoracic disk herniation are centrolateral (94%) and lateral (6%). Disks classified as centrolateral have the bulk of the disk herniation medial to the lateral margin of the thecal sac.Correct Answer: Centrolateral

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2492. (1210) Q6-1576:

A 38-year-old construction worker falls from a scaffolding and sustains a pure flexion-compression injury to T12. In this type of injury, which portion of the vertebral body fails first:

1) End plate
3) Posterior elements
2) Subcortical cancellous bone
5) Lamina
4) Middle column

Failure occurs first at the end plate. The intact intervertebral disk has limited compressibility. Therefore, when the compressive forces exceed the disk compressibility, the load is transmitted to the contiguous bone. The end plate will rupture first followed by the subcortical cancellous vertebral bone.Correct Answer: End plate

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2493. (1211) Q6-1578:

An absolute indication for surgical management of thoracolumbar burst fractures is:

1) Canal compromise greater than 10%
3) Kyphotic deformity greater than 10%
2) Canal compromise greater than 30%
5) Progressive neurologic deficit
4) Kyphotic deformity greater than 30%

Patients with a neurologic deficit or a progressive neurologic deficit should undergo operative decompression. Controversy exists as to the amount of kyphosis and canal compression that is considered acceptable. Support can be found in the literature for both operative and nonoperative management of neurologically intact burst fractures. Each patient must be evaluated on a case by case basis and followed closely after injury.Correct Answer: Progressive neurologic deficit

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2494. (1212) Q6-1579:

A 12-year-old girl presents with back pain of 3 monthsâ duration. She is a Risser stage 2. She displays a left thoracic curve of 27Â° on radiographs. The next study obtained in the work-up should be:

1) Lateral bending films
3) Head computerized tomography
2) Computerized tomography scan of the spine
5) Ultrasound of the kidneys
4) Magnetic resonance image of the thoracic spine

Left thoracic curves are unusual in idiopathic scoliosis. A magnetic resonance image of the thoracic spine is mandatory in the work-up to rule out diastematomyelia, tethered spinal cord, spinal tumor, or other type of congenital anomaly.Correct Answer: Magnetic resonance image of the thoracic spine

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2495. (1213) Q6-1580:

The most common organism responsible for vertebral column infection is:

1) *Pseudomonas aeruginosa*
3) *Staphylococcus aureus*
2) *Staphylococcus epidermidis*
5) *Mycobacterium tuberculosis*
4) *Escherechia coli*

Staphylococcus aureus accounts for more than 50% of spinal infections and often results from hematogenous dissemination. Gram-negative organisms are more common following genitourinary procedures or urinary tract infections. *Staphylococcus epidermidis* can complicate spinal surgical wounds, and polymicrobial infection is more common in these circumstances.Correct Answer: *Staphylococcus aureus*

2496. (1214) Q6-1581:

Symptoms of spinal infection may include all of the following except:

1) Activity-related back pain
3) Neurological deficit
2) Fever
5) Decreased spinal range of motion
4) Torticollis

Neck or back pain associated with spinal infection is relentless and constant. The pain is not usually associated with activity. There may be night pain as well. Other symptoms and signs are variable, requiring a high degree of suspicion. Fever occurs less than 50% of the time and neurological deficit less than 10% of the time. Paraspinal muscle spasms may result in decreased range of motion or torticollis.Correct Answer: Activity-related back pain

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2497. (1215) Q6-1582:

Which test is most specific for diagnosing spinal column infection:

1) White blood count
3) Carbon-reactive protein
2) Erythrocyte sedimentation rate
5) Biopsy
4) Blood culture

Vertebral biopsy, either via open or computed tomography-guided means, is most specific even though false-negative rates for closed and open biopsies are 30% and 14%, respectively.

- A patientâs white blood count may be normal even in acute spinal infection.
- Although often elevated, erythrocyte sedimentation rate and carbon-reactive protein are nonspecific tests.
- Blood cultures are negative in more than 75% of patients.

Correct Answer: Biopsy

2498. (1216) Q6-1583:

Which of the following describes the magnetic resonance image (MRI) appearance of vertebral osteomyelitis:

1) Increased signal onT1 images, decreased on T2 images
3) Decreased signal onT1 images, increased on T2 images
2) Decreased signal onT1 images, decreased on T2 images
5) MRI is usually unable to detect vertebral osteomyelitis
4) Increased signal onT1 images, increased on T2 images

Magnetic resonance image (MRI) carries a 95% accuracy rate. Infected disk and vertebral bone appear on MRI with decreased signal onT1 images and increased signal on T2 images. Gadoliniun enhancement is useful in differentiating spinal infection or abscess from epidural scar in the postoperative setting.Correct Answer: Decreased signal onT1 images, increased on T2 images

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2499. (1217) Q6-1584:

Appropriate treatment for spinal infection may include all the following except:

1) Antibiotics
3) Brace immobilization
2) Surgical decompression
5) Removal of spinal hardware in the chronic infection
4) Removal of spinal hardware in the acute postoperative setting

Spinal stability appears to improve healing of spinal infection. Chronic, persistent infections may require removal of hardware. Antibiotics and immobilization are the mainstays of treatment. Neurological deficit from epidural abscess or kyphotic collapse may require operative decompression.Correct Answer: Removal of spinal hardware in the acute postoperative setting

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2500. (1218) Q6-1585:

Which of the following is not a surgical indication in the treatment of spinal column infection:

1) Persistent back pain and elevated c-reactive protein despite 8 weeks of intravenous antibiotics and bracing
3) Progressive kyphotic collapse
2) Progressive neurological deficit and magnetic resonance image evidence of epidural abscess
5) Extension of infection into the disk space
4) Development of sepsis

Uncomplicated spinal osteomyelitis and diskitis are treated nonoperatively. Operative debridement, decompression, and stabilization may be useful in cases of abscess, sepsis, neurological deficit, and progressive deformity.Correct Answer: Extension of infection into the disk space

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2501. (1219) Q6-1586:

Which of the following is more characteristic of tuberculoid rather than pyogenic spinal infection:

1) Bony destruction on plain radiography
3) Prolonged onset of mild back pain despite extensive destruction seen on radiograph
2) Elevated erythrocyte sedimentation rate
5) Predilection for the cervical spine
4) High fevers, weight loss, and night pain

Spinal tuberculosis typically follows an indolent course early on despite radioqraphic findings out of proportion to the exam. Pyogenic and tuberculoid spinal infections involve the thoracic spine more commonly than the cervical spine. Both spinal infections may result in bony destruction, elevated erythrocyte sedimentation rates, and may or may not present with constitutional symptoms.Correct Answer: Prolonged onset of mild back pain despite extensive destruction seen on radiograph

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2502. (1220) Q6-1587:

Which of the following is a risk factor for neurological deficit associated with tuberculoid spinal infection:

1) Age
3) Erythrocyte sedimentation rate higher than 90
2) Pulmonary involvement
5) History of hypertension
4) History of smoking

Tuberculosis in the cervical spine of children younger than 10 years of age carries a significantly lower risk of paralysis than in older patients (17% vs 81%).Correct Answer: Age

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2503. (1221) Q6-1588:

All of the following organisms may cause granulomatous opportunistic spinal infection in immunocompromised patients except:

1) Mycobacteria
3) Actinomyces
2) Nocardia
5) Brucella
4) Staphylococcus

Staphylococcal infection is typically pyogenic, not granulomatous.Correct Answer: Staphylococcus

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2504. (1222) Q6-1589:

Antibiotic treatment for spinal tuberculosis includes all of the following except:

1) Isoniazid
3) Pyrazinamide
2) Ethambutol
5) Cefotaxime
4) Rifampin

A four-drug regimen against spinal tuberculosis is recommended because of the high prevalence of organism resistance. Cefotaxime is a cephalosporin not active against mycobacterial infection.Correct Answer: Cefotaxime

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2505. (1223) Q6-1590:

What percentage of spinal infections have concurrent positive blood cultures:

1) 5%
3) 55%
2) 25%
5) 95%
4) 75%

Even though the majority of spinal infections are considered hematogenous in origin, only 25% of infections occur with positive blood cultures.Correct Answer: 25%

2506. (1224) Q6-1591:

The treatment of choice for spinal epidural abscess is:

1) Four weeks of antibiotics
3) Surgical drainage plus a prolonged course of antibiotics
2) Parenteral antibiotics until the erythrocyte sedimentation rate falls to half of its pretreatment value
5) Bracing and analgesia
4) Spinal fusion

It is generally believed that pockets of pus, whether they are epidural, paravertebral, or psoas abscesses, must be drained in addition to antimicrobial therapy.Correct Answer: Surgical drainage plus a prolonged course of antibiotics

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2507. (1225) Q6-1592:

Which of the following antibiotics would not be useful in staphylococcal vertebral osteomyelitis:

1) Cefuroxime
3) Cefazolin
2) Nafcillin
5) Tobramycin
4) Ciprofloxicin

Aminoglycosides, such as tobramycin, are active against gram-negative organisms. First- and second-generation cephalosporins are alternatives to semisynthetic penicillins that may be useful if the organism is not resistant. Ciprofloxicin has also been considered a possible alternative to penicillins against gram-positive vertebral osteomyelitis.Correct Answer: Tobramycin

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2508. (1226) Q6-1593:

How common are spinal infections following penetrating injury to the spine:

1) 2%
3) 60%
2) 20%
5) 95%
4) 80%

One study found that 5 of 239 patients with gunshot or stab wounds developed meningitis, paravertebral abscess, vertebral osteomyelitis, or epidural abscess.Correct Answer: 2%

2509. (1227) Q6-1595:

Risk factors implicated in postoperative wound infection following lumbar spine surgery include all of the following except:

1) Use of instrumentation
3) History of smoking
2) Presence of spina bifida occulta
5) Obesity
4) Longer operative duration

Instrumented cases, preoperative history of smoking or obesity, and longer operating room duration have all been identified as possible risk factors for surgical site infection. Additionally, patient age may be a risk factor or may be associated with a risk factor like medical comorbidity or nutritional depletion.Correct Answer: Presence of spina bifida occulta

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2510. (1228) Q6-1596:

In the face of vertebral infection and progressive deformity, surgical reconstruction should:

1) Never use instrumentation
3) Always be approached posteriorly
2) Never use allograft bone
5) Always follow extensive antibiotic treatment until the infection is eradicated
4) Always involve an aggressive debridement

Surgical reconstruction in the face of spinal infection may be indicated should progressive neurological deficit or deformity occur. Such reconstruction may be successful if an aggressive debridement of all infectious foci is done, even if instrumentation or allograft is used. The optimal approach is dictated by the location of the infection and the type and degree of deformity (and is often anterior or anterior-posterior).Correct Answer: Always involve an aggressive debridement

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2511. (1229) Q6-1598:

The spinal surgical procedure associated with the highest rate of surgical site infection is:

1) Neuromuscular scoliosis fusion
3) Reduction and fusion of traumatic cervical facet fracture-dislocation
2) Lumbar spondylolisthesis fusion
5) Cervical laminectomy, foraminotomy, and arthrodesis
4) Lumbar stenosis decompression and fusion

Postoperative infection rates reach 11% for neuromuscular disease indications. For muscular dystrophy scoliosis surgery, the rate may be as high as 23%, for cerebral palsy 18%, and for myelomeningocele 11%.Correct Answer: Neuromuscular scoliosis fusion

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2512. (1230) Q6-1599:

Which of the following comprises the middle column in the Denis three-column model of the thoracolumbar spine:

1) Posterior longitudinal ligament, spinal canal, pedicles, and facet joints
3) Vertebral body, posterior longitudinal ligament, and disk
2) Facet joints, intertransverse membrane, and ligamentum flavum
5) Interspinous ligament, supraspinous ligament, and ligamentum flavum
4) Posterior half of the vertebral body, posterior half of the disk, and posterior longitudinal ligament

The middle column is composed of the posterior half of the vertebral body, posterior half of the disk, and posterior longitudinal ligament. The middle column, according to Denis, is important to determine the stability of a thoracolumbar fracture. There is the potential for instability when the middle column is disrupted.Correct Answer: Posterior half of the vertebral body, posterior half of the disk, and posterior longitudinal ligament

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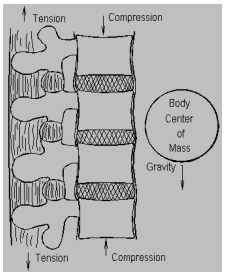
2513. (1231) Q6-1600:



Slide 1

Which type of biomechanical force(s) acts on the anterior portion of the thoracolumbar junction (T12-L2) at rest in a standing position:

1) Compression
3) Compression and tension
2) Compression and shear
5) Shear and torsion
4) Tension

The thoracolumbar junction is normally a straight portion of the spine (no lordosis or kyphosis) and the vertebral bodies are subject to compressive forces at rest when the patient is in a standing position. The posterior osteoligamentous structures are subject to tension along with the paraspinous muscles that help to maintain an upright posture.Correct Answer: Compression

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2514. (1232) Q6-1601:

Which of the following statements is true regarding the bulbocavernosus reflex:

1) This reflex is a sign of a spinal cord injury.
3) This reflex may be elicited by pulling on an indwelling catheter that causes a contraction of the cremaster muscle.
2) This reflex is mediated by the S3 and S4 segments of the spinal cord.
5) This reflex is mediated by the S3 and S4 segments of the spinal cord, and this reflex often means that a spinal cord injury is complete.
4) This reflex often means that a spinal cord injury is complete.

The bulbocavernosus reflex is mediated by the S3 and S4 regions of the spinal cord. This reflex is elicited by pulling on an indwelling catheter or squeezing the glans penis or clitoris and observing contraction of the anal sphincter. The bulbocavernosus reflex may be absent soon after a spinal cord injury due to spinal shock, but it often returns in 24 to 48 hours and indicates the end of spinal shock. A better sense of prognosis of a spinal cord injury is possible after spinal shock has ended.Correct Answer: This reflex is mediated by the S3 and S4 segments of the spinal cord.

2515. (1233) Q6-1602:

According to the Frankel grading scale for a neurologic injury, what is meant by Frankel C:

1) There is an antigravity motor function in some distal muscles below the level of the spinal cord injury.
3) There is muscle function, but not with adequate power to overcome gravity in some muscles below the level of the spinal cord injury.
2) There is an antigravity muscle function in the muscles 1 or 2 root levels below the spinal cord injury.
5) The patient has a chance for further neurologic recovery.
4) There is muscle function, but not with adequate power to overcome gravity in the muscles 1 or 2 root levels below the spinal cord injury.

The Frankel grading scale is used to communicate the extent of neurologic injury in the setting of a spinal cord injury.

- The A category indicates that there is no motor or sensory function below the level of the injury.
- The B category indicates that there is only sensory function below the level of the injury.
- The C category indicates that there is muscle function, but not with adequate power to overcome gravity in some muscles below the level of the spinal cord injury.
- The D category indicates that there is motor function with at least antigravity power below the level of the injury.
- The E category indicates that the muscle function below the level of the injury is normal in power. One can see some motor function for 1-2 root levels below the level of a spinal cord injury that is due to âroot escapeâ and should not be confused with distal motor sparing.

Correct Answer: There is muscle function, but not with adequate power to overcome gravity in some muscles below the level of the spinal cord injury.

2516. (1234) Q6-1603:

Which type of thoracolumbar fracture is associated with the highest incidence of intra-abdominal visceral trauma:

1) Burst fracture
3) Flexion-distraction injury
2) Compression fracture
5) Pathologic fracture
4) Fracture dislocation

The flexion-distraction injury was originally termed the âseatbelt injuryâ or in the case of a fracture proceeding through bone, a âChance fracture.â This injury is usually the result of a severe flexion force to the lumbar spine with flexion moment anterior to the spine (e.g., at a lap belt). Due to the severe energy dissipation at the level of the flexion moment, there is a high incidence of intra-abdominal visceral trauma.Correct Answer: Flexion-distraction injury

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2517. (1235) Q6-1604:

Which type of treatment would be most appropriate for a young, healthy patient with an incomplete spinal cord injury (ASIA C) 5 days following a T12 burst fracture with 30% canal compromise:

1) Bed rest, followed by hyperextension casting
3) Posterior fusion in situ
2) Posterior distractive instrumentation and fusion
5) Anterior T12 corpectomy, strut grafting, and instrumentation
4) Anterior T12 corpectomy and strut grafting

Surgery is indicated in patients with an incomplete spinal cord injury with spinal cord compression. Although some indirect decompression may be achieved early following the injury using posterior distractive instrumentation, the level of decompression is often better using an anterior approach (especially several days following the fracture). Following anterior decompression, either anterior instrumentation or posterior instrumentation is indicated to stabilize the construct and allow early mobilization.Correct Answer: Anterior T12 corpectomy, strut grafting, and instrumentation

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2518. (1236) Q6-1605:

Which of the following is the best indication for a laminectomy in a patient who has sustained a thoracolumbar burst fracture with a neurologic deficit:

1) Spinal cord compression
3) A small epidural hematoma is present on a magnetic resonance image
2) A lamina fracture is present on a computerized tomography scan
5) Greater than 50% canal compromise on a computerized tomography scan
4) Greater than 30Â° of kyphosis on a lateral radiograph

A laminectomy is never indicated as the sole method of treatment for a thoracolumbar burst fracture. Laminectomy creates additional instability at the level of the fracture and does not effectively decompress the spinal cord, which is compressed anteriorly from the retropulsed bony fragment. When lamina fractures are present on a computerized tomography scan, there is a significant incidence of dural tears and entrapped nerve tissue within the lamina fracture. Surgeons should consider performing a laminectomy in addition to other methods of achieving anterior decompression and stabilization of a burst fracture with a lamina fracture.Correct Answer: A lamina fracture is present on a computerized tomography scan

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2519. (1237) Q6-1606:

Which recommendations for the pharmacologic treatment of spinal cord injuries resulted from the NASCIS-II trials:

1) Treat all patients with a spinal cord injury with methylprednisolone 30 mg/kg over 1 hr followed by a maintenance rate of 5.4 mg/kg/hr for 23 hours.
3) Treat all patients with a spinal cord injury with decadron 10 mg/kg bolus followed by 1 mg/kg/hr for 23 hours.
2) Treat only patients who present within the first 8 hours of a spinal cord injury with methylprednisolone 30 mg/kg over 1 hr followed by a maintenance rate of 5.4 mg/kg/hr for 23 hours.
5) Treat only patients who present with complete spinal cord injuries within the first 8 hours of a spinal cord injury with methylprednisolone 30 mg/kg over 1 hr followed by a maintenance rate of 5.4 mg/kg/hr for 23 hours.
4) Treat only patients who present within the first 8 hours of a spinal cord injury with decadron 10 mg/kg bolus followed by 1 mg/kg/hr for 23 hours.

The NASCIS-II recommendations are to treat patients who present with an incomplete spinal cord injury within 8 hours of the injury with methylprednisolone 30 mg/kg over 1 hour followed by a maintenance rate of 5.4 mg/kg/hr for 23 hours. Because it is difficult to tell which patients have a complete or incomplete spinal cord injury in this time frame due to spinal shock, it has generally been accepted to treat all patients with spinal cord injuries with this treatment protocol as long as they present within the first 8 hours of the injury.Correct Answer: Treat only patients who present within the first 8 hours of a spinal cord injury with methylprednisolone 30 mg/kg over 1 hr followed by a maintenance rate of 5.4 mg/kg/hr for 23 hours.

2520. (1238) Q6-1607:

Which of the following statements is true regarding neurogenic shock:

1) Neurogenic shock is due to severe blood loss associated with a spinal cord injury.
3) Neurogenic shock is due to increased parasympathetic tone.
2) Neurogenic shock can be diagnosed when there is hypotension and tachycardia.
5) Neurogenic shock is a sign of an incomplete spinal cord injury.
4) Neurogenic shock is best treated with judicious use of fluids and vasopressors.

Neurogenic shock is present when there is a spinal cord injury interrupting sympathetic tone to the heart and blood vessels, and it is heralded by bradycardia and hypotension. It is important to maintain a reasonable blood pressure to prevent further damage to the spinal cord due to ischemia. In the absence of significant blood loss from another source, neurogenic shock must be treated with vasopressor medication and atropine. Severe neurogenic shock may require cardiac pacing. Fluids must be used carefully as overzealous use of fluid resuscitation can result in pulmonary edema.Correct Answer: Neurogenic shock is best treated with judicious use of fluids and vasopressors.

2521. (1239) Q6-1608:

Which is the best indication for surgical treatment of a patient with a thoracolumbar burst fracture:

1) 60% canal compromise by a retropulsed bony fragment
3) A fracture of the lamina present on a computerized tomography scan
2) 25Â° of kyphosis on the lateral radiograph
5) A polytrauma patient
4) An incomplete neurologic deficit

The exact indications for surgery vs nonoperative management of thoracolumbar burst fractures remains controversial. The best indication is an incomplete neurologic deficit with spinal cord compression. Other considerations include the degree of deformity (greater than 30Â° is generally considered appropriate to consider surgery) and the other injuries. Although much has been written about canal compromise, in the absence of a neurologic deficit it is not clear that surgery is always indicated due to canal compromise alone. Large canal fragments have been shown to resorb with conservative treatment.Correct Answer: An incomplete neurologic deficit

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2522. (1240) Q6-1609:

Which of the following patients is not at increased risk for isthmic spondylolisthesis:

1) Football lineman
3) Eskimo
2) Gymnast
5) Weight lifter
4) Nonambulatory patient

Isthmic spondylolisthesis is most common in white men and least common in black women. It is thought to arise from repetitive hyperextension of the lumbar spine causing a stress fracture of the pars intra-articularis. Sports such as weight lifting, gymnastics, football, and javelin throwing have a particularly high incidence of this condition. Isthmic spondylolisthesis is never present at birth and is rare in nonambulatory patients.Correct Answer: Nonambulatory patient

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2523. (1241) Q6-1610:

Which patient is at the lowest risk for progression of spondylolisthesis:

1) A 45-year-old man with grade II isthmic spondylolisthesis at L5-S1.
3) A 25-year-old man with a grade I isthmic spondylolisthesis at L4-5.
2) A 5-year-old girl with grade I dysplastic spondylolisthesis at L5-S1.
5) A 12-year-old girl with Grade II isthmic spondylolisthesis at L5-S1.
4) A 16-year-old boy with Grade III isthmic spondylolisthesis at L5-S1.

Young age, dysplastic spondylolisthesis, and spondylolisthesis above L5-S1 are all risk factors for progression. Adults with isthmic spondylolisthesis at L5-S1 (85% of cases) are at a low risk for progression of the slippage.Correct Answer: A 45-year-old man with grade II isthmic spondylolisthesis at L5-S1.

2524. (1242) Q6-1612:

What is the most common source of neurologic compression in a patient with lumbar spinal stenosis due to degenerative changes in the lumbar spine:

1) Disk
3) Superior articular process
2) Inferior articular process
5) Lamina
4) Pars intrarticularis

Degenerative spinal stenosis is the most common variety of spinal stenosis and usually manifests compression of the thecal sac in the lateral recess of the canal (defined as the area of the spinal canal between the facet joints and the intervertebral disk). The primary cause of stenosis is hypertrophy of the facet joint with compression from the superior articular process. This must be relieved for a patient to achieve an adequate decompression.Correct Answer: Superior articular process

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2525. (1940) Q6-2350:

Which of the following cervical spine nerve roots may cause paralysis of the diaphragm if injured during an anterior approach:

1) C3
3) C5
2) C4
5) C7
4) C6

The C4 cervical spine nerve root provides the primary innervation of the diaphragm.Correct Answer: C4

2526. (1941) Q6-2351:

The deltoid muscle may become paralyzed as a result of injury to which of the following cervical spine nerve roots:

1) C4
3) C6
2) C5
5) C8
4) C7

The deltoid muscle is almost entirely innervated by the C5 cervical spine nerve root.Correct Answer: C5

2527. (1942) Q6-2352:

The biceps reflex is diminished by compression of which of the following cervical spine nerve roots:

1) C4
3) C6
2) C5
5) C8
4) C7

Although there is a small contribution from the C6 cervical spine nerve root, the biceps reflex is primarily derived from the C5 cervical spine nerve root.Correct Answer: C5

2528. (1943) Q6-2353:

If the C5 cervical spine nerve root is injured during a decompression of the cervical spine, then sensation is lost over which of the following areas:

1) The lateral aspect of the arm from the shoulder to the elbow
3) The lateral border of the forearm including the thumb
2) The medial aspect of the arm from the shoulder to the elbow
5) The medial border of the forearm including the little finger
4) The middle finger

The C5 cervical spine nerve root supplies sensation from the lateral aspect of the arm from the shoulder to the elbow.

- C5 â Lateral aspect of the arm from the shoulder to the elbow
- C6 â Lateral border of the forearm including the thumb
- C7 â Middle finger
- C8 â Medial border of the forearm including the little finger
- T1 â Medial aspect of the arm from the shoulder to the elbow

Correct Answer: The lateral aspect of the arm from the shoulder to the elbow

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2529. (1944) Q6-2354:

If the C6 cervical spine nerve root is injured during a posterior decompression of the cervical spine, then sensation is lost in which of the following areas:

1) The lateral aspect of the arm from the shoulder to the elbow
3) The lateral border of the forearm including the thumb
2) The medial aspect of the arm from the shoulder to the elbow
5) The medial border of the forearm including the little finger
4) The middle finger

If the C6 cervical spine nerve root is injured during a posterior decompression of the cervical spine, then sensation is lost in which of the following areas:

- C5 â Lateral aspect of the arm from the shoulder to the elbow
- C6 â Lateral border of the forearm including the thumb
- C7 â Middle finger
- C8 â Medial border of the forearm including the little finger
- T1 â Medial aspect of the arm from the shoulder to the elbow

Correct Answer: The lateral border of the forearm including the thumb

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2530. (1945) Q6-2355:

If the C7 cervical spine nerve root is injured during a posterior decompression of the cervical spine, then sensation is lost in which of the following areas:

1) The lateral aspect of the arm from the shoulder to the elbow
3) The lateral border of the forearm including the thumb
2) The medial aspect of the arm from the shoulder to the elbow
5) The medial border of the forearm including the little finger
4) The middle finger

The C7 cervical spine nerve root supplies sensation to the skin over the volar aspect of the middle finger.

- C5 â Lateral aspect of the arm from the shoulder to the elbow
- C6 â Lateral border of the forearm including the thumb
- C7 â Middle finger
- C8 â Medial border of the forearm including the little finger
- T1 â Medial aspect of the arm from the shoulder to the elbow

Correct Answer: The middle finger

2531. (1946) Q6-2356:

If the C8 cervical spine nerve root is injured during a posterior spinal decompression, then sensation is lost over which of the following areas:

1) The lateral aspect of the arm from the shoulder to the elbow
3) The lateral border of the forearm including the thumb
2) The medial aspect of the arm from the shoulder to the elbow
5) The medial border of the forearm including the little finger
4) The middle finger

The C8 cervical spine nerve root supplies sensation to the medial border of the forearm including the little finger.

- C5 â Lateral aspect of the arm from the shoulder to the elbow
- C6 â Lateral border of the forearm including the thumb
- C7 â Middle finger
- C8 â Medial border of the forearm including the little finger
- T1 â Medial aspect of the arm from the shoulder to the elbow

Correct Answer: The medial border of the forearm including the little finger

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2532. (1947) Q6-2357:

If the brachioradialis reflex is diminished after a posterior spinal decompression, then which of the following nerve roots is injured:

1) C5
3) C7
2) C6
5) T1
4) C8

The brachioradialis reflex is mediated by the C6 cervical spine nerve root.

- C5 â Biceps
- C6 â Brachioradialis
- C7 â Triceps

Correct Answer: C6

2533. (1948) Q6-2358:

If the triceps muscle is weak after a spinal decompression, then which of the following nerve roots is injured:

1) C5
3) C7
2) C6
5) T1
4) C8

The triceps muscle extends the elbow and is innervated by the C7 cervical spine nerve root.

Motor innervations include:

- Shoulder abduction (deltoid) - - C5
- Elbow flexion - - C5
- Wrist extension - - C6, C7
- Wrist flexion - - C7
- Finger extension - - C7
- Finger flexion - - C8
- Finger abduction/adduction - - T1

Correct Answer: C7

2534. (1949) Q6-2359:

If the flexor carpi radialis is weak after a spinal decompression, then which of the following nerve roots is injured:

1) C5
3) C7
2) C6
5) T1
4) C8

The flexor carpi radialis is the most powerful wrist flexor and is innervated by the C7 cervical spine nerve root. The flexor carpi ulnaris, which is weaker than the flexor carpi radialis, is innervated by the C8 cervical spine nerve root.Correct Answer: C7

2535. (1950) Q6-2360:

A patient has a fracture dislocation of the cervical spine. Which of the following nerve roots must be spared to preserve intact finger extension:

1) C5
3) C7
2) C6
5) T1
4) C8

Finger extensors are innervated by the C7 cervical spine nerve root.

Motor innervations include:

- Shoulder abduction (deltoid) - - C5
- Elbow flexion - - C5
- Wrist extension - - C6, C7
- Wrist flexion - - C7
- Finger extension - - C7
- Finger flexion - - C8
- Finger abduction/adduction - - T1

Correct Answer: C7

2536. (1951) Q6-2361:

Which of the following nerve roots supplies motor innervation to the flexor digitorum superficialis (FDS):

1) C5
3) C7
2) C6
5) T1
4) C8

The FDS flexes the proximal interphalangeal joint and is innervated by the C8 cervical spine nerve root. The FDS is innervated peripherally by the median nerve.

The flexor digitorum profundus flexes the distal interphalangeal joint and is also innervated by the C8 cervical spine nerve root. The middle and index fingers are supplied by the median nerve, and the ring and little fingers are supplied by the ulnar nerve.Correct Answer: C8

2537. (1952) Q6-2364:

A patient with a herniated disk has a diminished patellar tendon reflex. Which of the following lumbosacral nerve roots is affected:

1) L1
3) L3
2) L2
5) L5
4) L4

The patellar tendon reflex is primarily transmitted through the L4 lumbosacral nerve root. Although the L4 lumbosacral nerve root is the primary transmitter, the L2 and L3 lumbosacral nerve roots also contribute to the fibers. A weak reflex is present if the L4 lumbosacral nerve root is completely cut and fibers of the L2 and L3 lumbosacral nerve roots are still present. The patellar tendon reflex is seldom completely absent unless a patient has primary muscle or anterior horn lesions.Correct Answer: L4

2538. (1953) Q6-2365:

A patient with radicular pain is experiencing skin numbness on the medial aspect of his leg and great toe. Which of the following nerve roots is effected:

1) L2
3) L4
2) L3
5) S1
4) L5

When examining patients, it is important to remember the sensory dermatomes. The medial aspect of the leg, foot, and great toe are supplied by the L4 lumbosacral nerve root. The tibial crest separates the L4 and L5 dermatomes on the leg.

- L4 Medial aspect of leg, foot, and great toe
- L5 Lateral aspect of the leg and toes 2 through 4
- S1 Lateral aspect of the fifth toe

Correct Answer: L4

2539. (1954) Q6-2366:

If the extensor hallucis longus muscle is weak in a patient who has radicular pain, then which of the following lumbosacral nerve roots is compressed:

1) L1
3) L3
2) L2
5) L5
4) L4

The extensor hallucis longus muscle is primarily innervated by the L5 lumbosacral nerve root.

The L5 lumbosacral nerve root innervates the following muscles:

- Extensor hallucis longus
- Extensor digitorum longus and extensor digitorum brevis
- Gluteus medius

Correct Answer: L5

2540. (1955) Q6-2367:

If the extensor digitorum longus and extensor digitorum brevis muscles are weak in a patient who has radicular back pain, then which of the following lumbosacral nerve roots is compressed:

1) L1
3) L3
2) L2
5) L5
4) L4

The extensor hallucis longus muscle is primarily innervated by the L5 lumbosacral nerve root.

The L5 lumbosacral nerve root innervates the following muscles:

- Extensor hallucis longus
- Extensor digitorum longus and extensor digitorum brevis
- Gluteus medius

Correct Answer: L5

2541. (1956) Q6-2368:

Testing of the L5 lumbosacral nerve root in a patient who has radicular back pain can be accomplished through which of the following reflexes or tests:

1) Patellar tendon reflex
3) Tibialis posterior reflex
2) Achilles tendon reflex
5) Beevor sign
4) Superficial anal reflex

Although there is not a well-defined reflex arc for the L5 lumbosacral nerve root, the tibialis posterior reflex can be elicited. The tibialis posterior reflex is mediated through the L5 lumbosacral nerve root.

Reflexes and associated nerve roots include:

- Patellar tendon --- L4
- Achilles tendon --- S1
- Superficial anal reflex --- S2, S3, S4
- Beevor sign refers to asymmetry of the segmental innervation of the rectus abdominus muscles and when performing a sit-up, there is unilateral segmental nerve root loss.

Correct Answer: Tibialis posterior reflex

2542. (1957) Q6-2369:

A patient with radicular pain is experiencing skin numbness on the lateral aspect of the leg and the dorsum of the foot between the second and fourth toes. Which of the following nerve roots is being compressed:

1) L1
3) L3
2) L2
5) L5
4) L4

The L5 dermatome covers the skin on the lateral leg and dorsum of the foot from the lateral border of the great toe to the medial border of the little toe.

- L4 Medial aspect of leg, foot, and great toe
- L5 Lateral aspect of the leg and toes 2 through 4
- S1 Lateral aspect of the fifth toe

Correct Answer: L5

2543. (1958) Q6-2370:

If the peroneus longus and peroneus brevis muscles are weak in a patient who has radicular back pain, then which of the following nerve roots is compressed:

1) L3
3) L5
2) L4
5) S2
4) S1

The peroneus brevis and peroneus longus muscles are principally innervated by the S1 nerve root through the superficial peroneal nerve. Although the nerve is principally innervated by the S1 nerve root, the superficial peroneal nerve is derived from the L5, S1, and S2 nerve roots.

The muscles principally innervated by the S1 nerve root are the:

- Peroneus longus and peroneus brevis
- Gastrocnemius-soleus complex
- Gluteus maximus

Correct Answer: S1

2544. (1959) Q6-2371:

The left medial and lateral gastrocnemius muscles are weak in a patient after a lumbar spine decompression. Which of the following nerve roots is injured:

1) L3
3) L5
2) L4
5) S2
4) S1

The medial and lateral gastrocnemius muscles are principally innervated by the S1 nerve root through the tibial nerve. Although the nerve is principally innervated by the S1 nerve root, the tibial nerve is derived from the L5, S1, and S2 nerve roots.

The muscles principally innervated by the S1 nerve root are the:

- Peroneus longus and peroneus brevis
- Gastrocnemius-soleus complex
- Gluteus maximus

Correct Answer: S1

2545. (1960) Q6-2372:

The Achilles tendon reflex (ankle reflex) is absent in a patient who has radicular back pain. Which of the following nerve roots is compressed:

1) L4
3) S1
2) L5
5) S3
4) S2

The Achilles tendon reflex is based on the triceps muscle group (medial and lateral gastrocnemius muscles and soleus muscle) and is transmitted through the S1 nerve root.

Reflexes and associated nerve roots include:

- Patellar tendon reflex L4
- Posterior tibial reflex L5
- Achilles tendon reflex S1

Correct Answer: S1

2546. (1961) Q6-2373:

A patient with cauda equina syndrome has decreased perianal sensation. Which of the following groups of nerve roots is involved:

1) L2, L3, and L4
3) L5, S1, and S2
2) L3, L4, and L5
5) S2, S3, S4, and S5
4) S1, S2, and S3

Perianal sensation is derived from the S2, S3, S4, and S5 nerve roots.

The sensory distribution is as follows:

- S4-S5 - - Innermost perianal ring
- S3 - - Middle perianal ring
- S2 - - Outermost perianal ring

Correct Answer: S2, S3, S4, and S5

2547. (1962) Q6-2374:

A patient with a fracture dislocation of the spine has a sensory level at the nipple line. Which of the following nerve root levels indicates this finding:

1) T2
3) T7
2) T4
5) T12
4) T10

In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels to localize pathologic processes.

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T4

2548. (1963) Q6-2375:

A patient with a fracture dislocation of the spine has a sensory level at the xiphoid process. Which of the following nerve root levels indicates this finding:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin over the xiphoid process area is innervated by the T7 nerve root.

In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels to localize pathologic processes.

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T7

2549. (1964) Q6-2376:

A patient with a fracture dislocation of the spine has a sensory level at the umbilicus. Which of the following nerve root levels indicates this finding:

1) T2
3) T7
2) T4
5) T12
4) T10

The skin of the umbilicus is innervated by the T10 nerve root.br>
In addition to knowing the innervation of selected muscles and the deep tendon reflexes, the clinician should also know the sensory levels to localize pathologic processes.

- T4 Nipple line
- T7 Xiphoid process
- T10 Umbilicus
- T12 Groin

Correct Answer: T10

2550. (1965) Q6-2377:

Which of the following statements regarding the presentation of thoracic disk herniations is false:

1) Pain is the principal symptom.
3) Mechanical axial back pain may be present.
2) Radicular pain may be present.
5) Bowel and bladder symptoms occur in more than 50% of affected patients.
4) Myelopathic pain may be present.

Patients with thoracic disk herniations may present with mechanical axial back pain, radicular pain, or myelopathy, but pain is the principal symptom. Bowel and bladder symptoms occur in 10% to 20% of affected patients.Correct Answer: Bowel and bladder symptoms occur in more than 50% of affected patients.

2551. (1966) Q6-2378:

Which of the following statements regarding the treatment of thoracic disk herniations is true:

1) The majority of patients can be treated nonoperatively.
3) Laminectomy is the surgical procedure of choice.
2) Surgical decompression is necessary in most cases.
5) Costotransversectomy is used for large central calcified herniations.
4) The anterior transthoracic approach is used for T1-T4 lesions.

The majority (75%) of patients with thoracic disk herniations may be managed nonoperatively. Surgical procedures must adequately decompress the involved nerve root. Posterior approach by laminectomy is usually not adequate, and costotransversectomy is not effective for large central calcified herniations (an anterior approach is preferred). The anterior transthoracic approach is effective for T5-T12 lateral and anterior disk herniations.Correct Answer: The majority of patients can be treated nonoperatively.

2552. (2177) Q6-2603:

Which of the following is the only accepted pharmacological agent for the acute treatment of a spinal cord injury:

1) GM-1 ganglioside
3) Nimodipine (calcium channel blocker)
2) Tirilazad (lipid peroxidation inhibitor)
5) Methylprednisolone
4) Naloxone (opoid antagonist)

Methylprednisolone is currently the only accepted pharmacologic agent for the treatment of spinal cord injury. The North American Spinal Cord Injury Studies (NASCIS) found significant motor and sensory improvement in patients who were treated within 8 hours of injury with a methylprednisolone bolus of 30 mg/kg, followed by an infusion of 5.4 mg per hour for 24 hours.

Other agents have been studied in animal experiments but have not been promising in clinical trials.Correct Answer: Methylprednisolone

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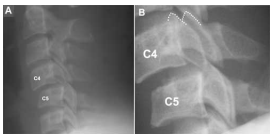
2553. (2178) Q6-2604:



Slide 1

A 45-year-old man has neck pain following a motor vehicle accident. His neurologic examination is normal. His plain radiographs are shown (Slide). The most likely diagnosis is:

1) Cervical strain (whiplash-type injury)
3) Unilateral facet dislocation
2) Compression fracture of C5
5) Spinous process fracture
4) Bilateral facet dislocation

The lateral radiograph shows translation and kyphosis at the level of injury. The facets of C4 do not superimpose on each to create a "double sail" sign. This patient has a unilateral facet dislocation. With unilateral facet dislocations, there is usually 3 mm to 4 mm of forward translation and 5Â° to 7Â° of angulation.Correct Answer: Unilateral facet dislocation

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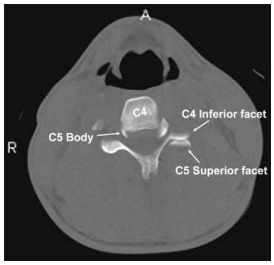
2554. (2179) Q6-2605:



Slide 1

A 35-year-old man has neck pain following a motor vehicle accident. His axial computed tomography scan is shown (Slide). The most likely diagnosis is:

1) C4 compression fracture
3) Bilateral facet dislocation
2) Clay shovelers fracture
5) Pseudosubluxation of C4 on C5
4) Unilateral facet dislocation

The axial computed tomography scan of C4-C5 shows a unilateral facet dislocation. Notice that the superior facet of C5 lies posterior to the inferior facet of C4. This relationship should be the exact opposite. Also, notice that C4 is rotated on the body of C5 and translated forward.Correct Answer: Unilateral facet dislocation

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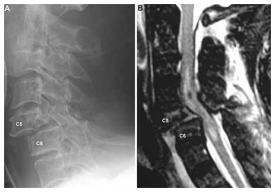
2555. (2180) Q6-2607:



Slide 1

A 40-year-old woman has severe neck pain following a motor vehicle accident. Her plain lateral radiograph of the spine is shown (Slide). A sagittal magnetic resonance scan is shown (Slide). The most likely diagnosis is:

1) Pseudosubluxation of C5 on C6
3) Unilateral facet dislocation
2) Compression fracture of C5
5) Degenerative sponylolisthesis C5 on C6
4) Bilateral facet dislocation

There is significant subluxation of C5 on C6 on the plain radiograph. The facets of C5 and C6 have lost their normal relationship. This patient has a bilateral facet dislocation. There is compression and significant changes within the spinal cord. This patient should be treated with reduction and fusion.Correct Answer: Bilateral facet dislocation

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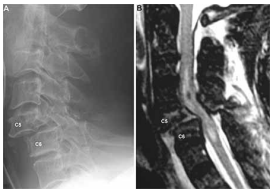
2556. (2181) Q6-2608:



Slide 1

A 40-year-old woman has severe neck pain following a motor vehicle accident. Her plain lateral radiograph of the spine is shown (Slide). A sagittal magnetic resonance is shown (Slide). The most appropriate treatment would be:

1) Observation
3) Reduction and collar immobilization
2) Neck collar and physical therapy
5) Reduction and fusion
4) Reduction and halo immobilization

There is significant subluxation of C5 on C6 on the plain radiograph. The facets of C5 and C6 have lost their normal relationship. This patient has a bilateral facet dislocation. There is compression and significant changes within the spinal cord.

This patient should be treated with reduction and fusion. This is a ligamentous injury so reduction and immobilization will not result in satisfactory healing.Correct Answer: Reduction and fusion

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2557. (2182) Q6-2609:

In which of the following nerve roots is compression neuropathy common in cervical spondylosis:

1) C3 and C4
3) C5 and C6
2) C4 and C5
5) C7 and C8
4) C6 and C7

The nerve roots that are most commonly affected in cervical spondylosis are C6 and C7, secondary to degenerative changes in the C5-C6 and C6-C7 nerve roots. Patients may have specific dermatomal pain or pain that is diffuse and poorly localized.Correct Answer: C6 and C7

2558. (2183) Q6-2610:

Which of the following sensory areas is affected by compression of the C6 nerve root:

1) Lateral forearm into the radial side of the hand
3) Posterior neck, occiput
2) Base of neck, medial shoulder
5) Posterolateral forearm into the middle finger of the hand
4) Ulnar side of the forearm and hand

It is important to remember the sensory dermatome when examining patients who have neck and upper extremity pain:

C3	Posterior neck, occiput
C4	Base of neck, medial shoulder
C5	Base of neck to shoulder and upper arm
C6	Lateral forearm into the radial side of the hand
C7	Posterolateral forearm into the middle finger of the hand
C8	Ulnar side of the forearm and hand

Correct Answer: Lateral forearm into the radial side of the hand

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2559. (2184) Q6-2611:

Which of the following sensory areas is affected by compression of the C7 nerve root:

1) Base of neck, medial shoulder
3) Lateral forearm into the radial side of the hand
2) Base of neck to shoulder and upper arm
5) Ulnar side of the forearm and hand
4) Posterolateral forearm into the middle finger of the hand

It is important to remember the sensory dermatome when examining patients who have neck and upper extremity pain:

C3	Posterior neck, occiput
C4	Base of neck, medial shoulder
C5	Base of neck to shoulder and upper arm
C6	Lateral forearm into the radial side of the hand
C7	Posterolateral forearm into the middle finger of the hand
C8	Ulnar side of the forearm and hand

Correct Answer: Posterolateral forearm into the middle finger of the hand

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2560. (2185) Q6-2612:

Slide 1

A patient comes into your office with neck and arm pain. The patientâs plain radiograph is shown (Slide). Which of the following signs is most likely to be found on physical examination:

1) Triceps muscle weakness
3) Finger flexion weakness
2) Deltoid muscle weakness
5) Numbness on the ulnar side of the forearm and hand
4) Numbness on the lateral forearm into the radial side of the hand

The lateral radiograph shows narrowing of the C5-C6 intervertebral disk space with osteophytes arising anteriorly and posteriorly. This degenerative process results in facet joint hypertrophy, osteophytes in the uncovertebral joints, and hypertrophy of the ligamentum flavum. The C6 nerve root is compressed resulting in numbness on the lateral forearm into the radial side of the hand. Elbow and wrist extension may be affected, and the biceps tendon reflex may be diminished or absent.

It is important to remember the sensory dermatome when examining patients who have neck and upper extremity pain:

C3	Posterior neck, occiput
C4	Base of neck, medial shoulder
C5	Base of neck to shoulder and upper arm
C6	Lateral forearm into the radial side of the hand
C7	Posterolateral forearm into the middle finger of the hand
C8	Ulnar side of the forearm and hand

Correct Answer: Numbness on the lateral forearm into the radial side of the hand

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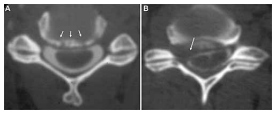
2561. (2186) Q6-2613:



Slide 1 **Slide 2**

A 45-year-old woman has pain in her right upper extremity and neck. The plain film is is presented (Slide 1) as well as an axial post myelogram CT images (Slide 2, A & B). Her pain has not responded to nonsteroidal anti-inflammatory drugs or physical therapy. Which of the following is the most appropriate treatment:

1) Needle aspiration of the C4-C5 intervertebral space
3) Needle biopsy of C4 or C5
2) 6-week course of antibiotics and bracing
5) Anterior cervical diskectomy
4) Mammography and technetium bone scan

The axial post myelogram CT image shows a disk herniation, and the sagittal view shows prominent osteophytes. There is no evidence of an infection or a neoplasm. This patient is a candidate for anterior disckectomy and fusion.Correct Answer: Anterior cervical diskectomy

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2562. (2327) Q6-2781:

Plain radiographs of the lumbosacral spine are useful for:

1) Detecting marrow changes
3) Distinction between disk material and the dural sac
2) Far lateral herniated intervertebral disks
5) Instability patterns
4) Lateral recess stenosis

Plain radiographs are useful for assessing the alignment of the spine, bone destruction by tumors and infections, and instability patterns. The radiographs also will show degenerative intervertebral disks.

Plain radiographs are not sensitive for detecting marrow changes, herniated disks, and neural compression secondary to degenerative changes.

Correct Answer: Instability patterns

2563. (2328) Q6-2782:

Computerized tomography scans are efficacious for detecting which of the following conditions:

1) Marrow changes
3) Intrathecal abnormalities
2) Lytic lesion suspected on Plain L spine film
5) Intervertebral disk hydration
4) Instability patterns

Computerized tomography scans are excellent for assessing bone structure, especially in patients with metastatic bone disease and primary bone tumors of the spine. Computerized tomography is useful for distinguishing between bone and soft tissue compression in neural compressive disorders.Correct Answer: Lytic lesion suspected on Plain L spine film

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2564. (2405) Q6-2864:

A 35-year-old construction worker has left leg pain and difficulty walking. His examination is normal except for decreased sensation to the lateral border of the left foot, the inability to walk on the toes of the left foot, and a positive stretch test producing left heel and lateral foot pain. A magnetic resonance image shows a large posterolateral herniated nucleus pulposus on the left side at L5-S1. The gait abnormality is most likely due to:

1) Cauda equina syndrome
3) L5 radiculopathy and extensor hallucis longus weakness
2) L5 radiculopathy and gastrocsoleus muscle complex denervation
5) S2 denervation and extensor hallucis longus weakness
4) S1 radiculopathy and gastrocsoleus muscle complex denervation

In the lumbar spine, direct posterior and posterolateral disk herniations typically compress the traversing nerve root. In this patient, the herniated disk at the L5-S1 level compresses the shoulder of the S1 nerve root as it comes off the dural sac. The S1 nerve root supplies sensation to the posterior calf and lateral border of the foot, and motor chiefly to the gastrocsoleus muscle complex.Correct Answer: S1 radiculopathy and gastrocsoleus muscle complex denervation

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2565. (2406) Q6-2865:

Which of the following types of neural dysfunction is present with a cervical fracture-dislocation, resulting in a Brown-Sequard neurological injury:

1) Ipsilateral loss of pain, temperature recognition, and contralateral loss of motor function
3) Bilateral loss of pain/temperature and unilateral loss of motor
2) Ipsilateral loss of motor and contralateral loss of pain/temperature
5) Bilateral upper extremity loss of motor and unilateral lower extremity loss of pain/temperature
4) Bilateral loss of motor and unilateral loss of pain/temperature

A Brown-Sequard injury causes damage to half of the spinal cord. Brown-Sequard injuries produce ipsilateral proprioceptive and motor loss and contralateral loss of sensitivity to pain and temperature. Proprioceptive sensory fibers enter the spinal cord, travel in the dorsal columns and lateral and ventral spinothalmic tracts, and decussate high in the thalamus. Motor efferent nerves cross in the medulla and travel down in the lateral corticospinal tracts.Spinthalamic fibers enter and decussate in the spinal cord. Hence, cord hemi-section produces contralateral pain and temperature (spinothalamic) loss, and ipsilateral motor (corticospinal) and, proprioceptive (dorsal columns) deficit. Often due to penetrating injuries, Brown-Sequard injuries have the best prognosis of the cord injury complexes.Correct Answer: Ipsilateral loss of motor and contralateral loss of pain/temperature

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2566. (2407) Q6-2866:

Slide 1

The axial computed tomography scan depicts a patient with spinal stenosis (Slide). The primary source of neural compression is impingement on the traversing nerve root by the:

1) Superior facet of the level below
3) Redundant ligamentum flavum
2) Inferior facet of the level above
5) Herniated nucleus pulposus
4) Overgrown medial pedicle

Spinal stenosis involves narrowing of the spinal canal by a combination of factors. Degeneration of the disk with dehydration allows loss of disk height and bulging posteriorly into the canal. The ligamentum flavum becomes redundant at the segment due to loss of the disk height and buckling of the ligament. Chief among the sources of compression, however, is the overgrowth of the facet joint, which acts to autostabilize the motion segment. The facets are oriented in an oblique plane, depending on the level involved. The superior facet of the subjacent vertebral body lies anterior and lateral to its counterpart from the level above, forming a shingle configuration. The superior articular process, therefore, lies adjacent to the shoulder of the traversing nerve root and is a significant source of lateral recess stenosis.Correct Answer: Superior facet of the level below

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2567. (2408) Q6-2867:

Slide 1

The type of disk herniation shown (Slide) at the L5-S1 level is most likely to cause:

1) Quadriceps weakness and numbness of the medial thigh
3) Weakness of the tibialis anterior
2) Diminished sensation to the anteromedial calf
5) Extensor hallucis longus weakness
4) Weakness of the gastrocsoleus complex

This slide shows a posterolateral disk herniation on the right. Posterolateral disk herniations cause compression of the traversing S1 nerve root at this level. Sensation affected is the posterior calf and lateral border of the foot, while motor innervation is to the gastroc soleus complex. With far lateral disk herniations, the exiting nerve root is compressed and symptoms may be seen referred to the level above.Correct Answer: Weakness of the gastrocsoleus complex

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2568. (2409) Q6-2868:

Which of the following populations is most at risk for compression fractures of the spine:

1) Middle-aged black women
3) Menopausal females of Inuit (Alaskan native) descent
2) Elderly caucasian men
5) Heavy laborers
4) Elderly fair-skinned women of northern European descent

Osteoporosis is an age-related decrease in bone mass usually associated with a loss of estrogen in postmenopausal women. Sedentary, thin white women of northern European descent are most severely affected. In addition, smoking, heavy drinking, and certain pharmacological agents, such as phenytoin, increase the severity of the disease. Women who breastfed their infants or those with low vitamin D or calcium diets are also at increased risk.Correct Answer: Elderly fair-skinned women of northern European descent

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2569. (2410) Q6-2869:

Following an osteoporotic compression fracture, the risk of sustaining another compression fracture at a different level is increased by:

1) 2 times
3) 8 times
2) 5 times
5) 15 times
4) 10 times

Osteoporosis is a systemic disease affecting more than 24 million Americans. Osteoporosis results in progressive bone mineral loss and concurrent changes in bony architecture, which leave the spinal column vulnerable to compression fractures, often after minimal or no trauma. There are an estimated 700,000 osteoporotic vertebral compression fractures (VCFs) in the United States each year, of which more than one third become chronically painful. Approximately 85% of VCFs are due to primary osteoporosis and the remainder due to secondary osteoporosis or malignancies. These VCFs lead to progressive sagittal spine deformity and changes in spinal biomechanics and are believed to contribute to a fivefold increased risk of further fracture by virtue of force transmission to weak vertebrae above or below. Whether the fracture is painful or not, the spinal deformity caused by two or more fractures dramatically impacts health, daily living, and medical costs through loss of lung capacity, loss of appetite, reduced mobility, chronic pain, and/or clinical depression.Correct Answer: 5 times

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2570. (2411) Q6-2870:

The following are all purported benefits of percutaneous intraosseous methylmethacrylate injection (vertebroplasty) for the treatment of osteoporotic compression fractures except:

1) Decreased stiffness of the segment, distributing stress at adjacent levels
3) Prevention of further compression fractures by restoring sagittal alignment
2) Rapid pain relief
5) Increased mobility leading to prevention of further osteoporosis
4) Faster return to ambulation

Traditional treatment for patients with osteoporotic vertebral compression fractures (VCFs) includes bed rest, analgesics, and bracing. This type of medical management does not restore spinal alignment, and the lack of mobility increases the rate of demineralization. Because of the inherent risks and invasive nature, surgical treatment of osteoporotic VCFs has been limited to patients with concurrent spinal instability or neurologic compromise. Reconstruction with structural bone graft and instrumentation may be performed from an anterior or posterior approach; however, the success of these techniques is limited by a patientâs poor bone quality and general medical condition.

Augmentation of VCFs with polymethylmethacrylate (PMMA), "vertebroplasty," involves the forced injection of low viscosity PMMA cement into the closed space of the collapsed vertebral body. Although vertebroplasty is currently being used successfully for pain relief in VCFs, this technique does not restore the height of the collapsed vertebral body.Correct Answer: Decreased stiffness of the segment, distributing stress at adjacent levels

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2571. (2412) Q6-2871:

Acute thoracic compression fractures should have the following signal characteristics on magnetic resonance imaging:

1) High signal on T1 and T2
3) High signal on T1 and low signal on T2
2) Low signal on T1 and T2
5) Intermediate signal on both T1 and T2
4) Low signal on T1 and high signal on T2

Acute fractures produce local hematomas that displace the adipose tissue normally present in the bone marrow and decrease the signal uptake from fat on T1-weighted sequences. Fractures also produce edema, which is bright on T2-weighted sequences. Acute thoracic compression fractures should be low signal intensity on T1 sequences and high on T2 sequences.Correct Answer: Low signal on T1 and high signal on T2

2572. (2413) Q6-2872:

Slide 1

In this slide of a lumbar burst fracture, which column is disrupted to distinguish it from a compression fracture:

1) Anterior
3) Posterior
2) Lateral
5) Medial
4) Middle

Denis was the first surgeon to include the middle column in his description of thoracolumbar fractures and to accentuate its importance in fracture stability. The defining characteristic of a burst fracture is disruption of the middle column, which distinguishes these fractures from compression fractures. Involvement of the middle column indicates an unstable fracture pattern.Correct Answer: Middle

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2573. (2414) Q6-2873:

When evaluating thoracolumbar burst fractures, it is important to remember that the spinal cord ends in the conus medullaris, which typically is present at what level:

1) T10
3) L2
2) L1
5) L4
4) L3

While the conus medullaris can end anywhere from T12 to L3, in the majority of patients it is present at the L1 level. Injury at this level is much different from injury to the spinal cord or the cauda equina.Correct Answer: L1

2574. (2415) Q6-2874:

Slide 1

Canal compromise in burst fractures (Slide) is caused by:

1) Lamina fracture and anterior migration
3) Retropulsion of the posterosuperior vertebral body
2) Migration of the posteroinferior vertebral body
5) Herniated disk material
4) Narrowing of the interpedicular distance

An essential component of burst fractures, as described first by Denis, is the involvement of the middle column. Typically, the posterosuperior vertebral body is separated from the remainder of the body and encroaches into the spinal canal, causing damage to the neural elements. No other part of the middle column is a standard component of the injury.Correct Answer: Retropulsion of the posterosuperior vertebral body

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2575. (2416) Q6-2875:

A 16-year-old boy sustains a burst fracture of L2. Radiographs indicate loss of approximately 20% of vertebral height anteriorly and 10Â° of kyphosis. He is neurologically intact. Management should include:

1) Anterior decompression and strut graft reconstruction
3) Laminectomy, open reduction of the bony intrusion, and fusion
2) Posterior indirect decompression with transpedicular instrumentation and fusion
5) Delayed reconstruction of the spine when the initial injury has been determined
4) An initial period of bed rest, monitoring the patient for ileus, and early mobilization in an extension orthosis or body cast

Burst fractures represent 17% of major spine fractures. Instability and failure occur in the anterior and middle columns. Fifty percent of patients have a neurologic deficit. These fractures are considered unstable if there is more than 50% to 60% anterior compression, 20Â° to 25Â° of kyphosis, more than 50% of canal compromise, and posterior injury. Incomplete or progressive neurologic deficits require early decompression and stabilization. Treatment of the stable fracture without neurologic deficit is hyperextension bracing for 3 to 4 months.Correct Answer: An initial period of bed rest, monitoring the patient for ileus, and early mobilization in an extension orthosis or body cast

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2576. (2417) Q6-2877:

The sagittal plumb line should fall:

1) Anterior to the C4 vertebral body
3) Posterior to the anterosuperior corner of S1
2) Through the L3-L4 intervertebral disk
5) Anterior to the S1 body
4) Through the T11 intervertebral disk

Radiographic assessment of the sagittal balance is usually made with a patient standing, with his or her arms flexed forward 90Â° and supported on a bar. Radiographic assessment is recorded on a 36-inch cassette. Several reference points regarding this technique have appeared in the literature. These points include a plumb line through the center of the C7 vertebral body, passing 35 mm to 56 mm posterior to the anterosuperior border of S1.Correct Answer: Posterior to the anterosuperior corner of S1

2577. (2418) Q6-2879:

Normal sagittal thoracic alignment is:

1) 5Â° to 10Â° of kyphosis due to the adjacent lordotic cervical and lumbar segments
3) Lordotic to support the body weight anteriorly
2) Straight because of the rib cage
5) 60Â° to 80Â° of kyphosis between T1 and T10
4) 20Â° to 50Â° of kyphosis between T1 and T10

Thoracic kyphosis has contributions from the trapezoidal shapes of the thoracic vertebrae, from the intevertebral disk positions, and from the stiffness of the ribs and sternum. The reported normal values range from 20Â° to 50Â°.Correct Answer: 20Â° to 50Â° of kyphosis between T1 and T10

2578. (2441) Q6-2902:

A 70-year-old man complains of severe, burning pain in both calves after he ambulates approximately one block. He denies significant back pain. He has long-standing, insulin-dependent diabetes mellitus and a history of coronary artery disease. The patient has smoked two packs of cigarettes each day for more than 30 years. What questions from his history can help differentiate vascular from neurogenic claudication:

1) Distribution of pain
3) Posture changes
2) Pattern of sensory loss
5) Timing of symptom onset
4) Relief of pain with rest

Pain distribution may be similar in vascular and neurogenic claudication. The pattern of patient-reported sensory loss is unlikely to be contributory due to the patientâs history of insulin-dependent diabetes and, presumably, a diabetic peripheral neuropathy. In both syndromes, pain is relieved with rest. Usually, pain relief is quicker in vascular claudication. In neurogenic claudication, standing alone may not relieve patient symptoms; sitting is usually required. Timing of symptom onset is variable in both syndromes. Vascular claudication usually produces less variability in exercise tolerance. Relief of pain with changes in posture (bending over a walker or shopping cart) is found only in neurogenic claudication.

Correct Answer: Posture changes

2579. (2442) Q6-2903:

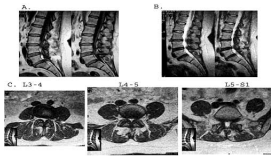
A 70-year-old man complains of severe, burning pain in both calves after he ambulates approximately one block. He denies significant back pain. He has long-standing, insulin-dependent diabetes mellitus and a history of coronary artery disease. The patient has smoked two packs of cigarettes each day for more than 30 years. The patient is diagnosed with neurogenic claudication. What is the most likely source of his symptoms:

1) Herniated lumbar disk
3) Degenerative spinal stenosis at L3-L4
2) Isthmic spondylolisthesis
5) Metastatic tumor
4) Degenerative spinal stenosis at L4-L5

The most common cause of neurogenic claudication in this patient is degenerative stenosis. L4-L5 is the most commonly affected level. Herniated lumbar disk is less likely. Although a metastatic tumor is possible, especially in light of the patientâs smoking history, the absence of back pain makes this unlikely.

Correct Answer: Degenerative spinal stenosis at L4-L5

2580. (2443) Q6-2905:



Slide 1

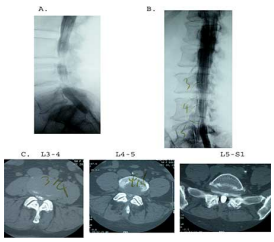
A 70-year-old man complains of severe, burning pain in both calves after he ambulates approximately one block. He denies significant back pain. He has long-standing, insulin-dependent diabetes mellitus and a history of coronary artery disease. The patient has smoked two packs of cigarettes each day for more than 30 years. A magnetic resonance image (MRI) of the patient is obtained (Slide). What does the MRI show:

1) Critically severe stenosis at L3-L4 and L4-L5
3) Herniated lumbar disk
2) Moderate lumbar spinal stenosis at L3-L4 and L4-L5
5) Lumbar metastatic disease
4) Moderate lumbar stenosis at L3-L4, L4-L5, and L5-S1

The MRI shows moderately severe lumbar stenosis at L3-L4 and L4-L5. While the degree or severity of stenosis remains subjective, terming this stenosis critical is an exaggeration. The section of the axial images at L5-S1 is not in plane with the disk, hence there appears to be lateral recess stenosis at this level also. The sagittal images, however, do not confirm this diagnosis. There is no evident lumbar disk herniation, and there are no findings indicative of lumbar metastatic disease.

Correct Answer: Moderate lumbar spinal stenosis at L3-L4 and L4-L5

2581. (2444) Q6-2907:



Slide 1

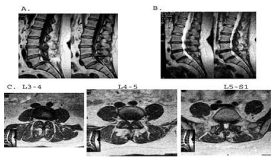
A 70-year-old man complains of severe, burning pain in both calves after he ambulates approximately one block. He denies significant back pain. He has long-standing, insulin-dependent diabetes mellitus and a history of coronary artery disease. The patient has smoked two packs of cigarettes each day for more than 30 years. A magnetic resonance image (MRI) of the patient is obtained, as well as a myelogram (Slide). Conservative options in this patient include:

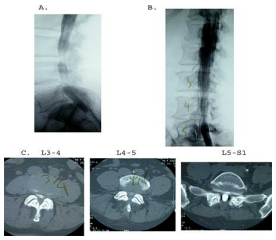
1) Medication
3) Conditioning exercise
2) Epidural steroids
5) None of the above, proceed to surgery
4) All of the above

The myelogram confirms the diagnosis of lumbar spinal stenosis at L3-L4 and L4-L5. There is no myelographic block, although the stenosis is significant. A trial of conservative therapy is appropriate for this patient.

Correct Answer: All of the above

2582. (2445) Q6-2908:





Slide 1 **Slide 2**

A 70-year-old man complains of severe, burning pain in both calves after he ambulates approximately one block. He denies significant back pain. He has long-standing, insulin-dependent diabetes mellitus and a history of coronary artery disease. The patient has smoked two packs of cigarettes each day for more than 30 years. Based upon the patientâs history, magnetic resonance image (MRI) (Slide 1), and computed tomography (CT)-myelogram (Slide 2) available for your review, what is the correct diagnosis in this patient:

1) Lumbar metastatic disease
3) Lumbar herniated disk
2) Lumbar spinal stenosis
5) Ankylosing spondylitis
4) Degenerative lumbar spondylolisthesis

There is no evidence of lumbar metastases in this patient. The CT-myelogram shows compression arising posterior to the thecal sac, making a disk herniation less likely. Similarly, there is no evidence of a lumbar disk herniation on MRI. The patientâs sagittal alignment is well maintained, with no spondylolisthesis evident. Ankylosing spondylitis generally presents in younger patients, and the classic radiographic finding of spontaneous arthrodesis is not present.

Correct Answer: Lumbar spinal stenosis

2583. (2446) Q6-2909:

A 75-year-old woman presents with low back pain that is worse with motion and bilateral lower extremity pain that is worse with ambulation. She notes that the pain extends down the posterior aspects of her lower extremities, from the buttocks to the calves. The pain limits her activity â she can only ambulate approximately one block before having to rest. She reports that lumbar flexion, notably leaning over a walker or a shopping cart, considerably diminishes her lower extremity pain. She has a significant past medical history of coronary artery disease, and she has had previous angioplasty of her coronary vessels. On examination, her lower extremity pulses are easily palpable. What would you expect to find on this patientâs neurological examination:

1) No abnormal findings on the neurological examination
3) Severe proximal lower extremity weakness
2) Mild proximal lower extremity weakness
5) Severe distal lower extremity weakness
4) Mild distal lower extremity weakness

Lumbar spinal stenosis is a dynamic process. Patients classically have no deficit until they are physically active. Therefore, this patient may not have a deficit during her clinic examination. It would be unusual for her to present with a fixed lower extremity deficit.

Correct Answer: No abnormal findings on the neurological examination

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2584. (2447) Q6-2910:

A 75-year-old woman presents with low back pain that is worse with motion and bilateral lower extremity pain that is worse with ambulation. She notes that the pain extends down the posterior aspects of her lower extremities, from the buttocks to the calves. The pain limits her activity â she can only ambulate approximately one block before having to rest. She reports that lumbar flexion, notably leaning over a walker or a shopping cart, considerably diminishes her lower extremity pain. She has a significant past medical history of coronary artery disease, and she has had previous angioplasty of her coronary vessels. On examination, her lower extremity pulses are easily palpable. What radiographic evaluation would you obtain to best establish her diagnosis:

1) Plain L-spine films
3) MRI of cervical spine
2) Angiogram of lower extremity vessels
5) Magnetic resonance image (MRI) of lumbar spine
4) Computed tomography (CT) of lumbar spine

The most efficacious and least invasive means of evaluation for lumbar spinal stenosis is MRI. A CT scan, while showing bony anatomy well, may not provide adequate information about soft tissue structures. Plain films are nonspecific and, although they are often used as an initial evaluation, may not yield adequate diagnosis. This patientâs symptom complex does not correlate with vascular claudication.

Correct Answer: Magnetic resonance image (MRI) of lumbar spine

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2585. (2448) Q6-2913:

A 75-year-old woman presents with low back pain that is worse with motion and bilateral lower extremity pain that is worse with ambulation. She notes that the pain extends down the posterior aspects of her lower extremities, from the buttocks to the calves. The pain limits her activity â she can only ambulate approximately one block before having to rest. She reports that lumbar flexion, notably leaning over a walker or a shopping cart, considerably diminishes her lower extremity pain. She has a significant past medical history of coronary artery disease, and she has had previous angioplasty of her coronary vessels. On examination, her lower extremity pulses are easily palpable. This patient is diagnosed with degenerative spondylolisthesis with significant lateral recess stenosis. Treatment of this patient could include:

1) Epidural steroids
3) Decompression with noninstrumented fusion
2) Decompression alone
5) All of the above
4) Decompression with instrumented fusion

Treatment options for this patient are legion. Considering her significant coronary artery disease, a conservative approach using anti-inflammatory drugs, physical therapy, and epidural steroids might be chosen by some physicians. Surgical options include decompression alone or decompression with fusion. This patientâs significant mechanical low back pain encourages some surgeons to include a fusion with the decompression.

Correct Answer: All of the above

2586. (2493) Q6-2960:

The distinguishing phenotypic feature that differentiates a schwannoma from a neurofibroma is:

1) The consistently hard and irregular surface of a schwannoma tumor
3) The presence of a dissection plane between the tissue and a schwannoma tumor
2) The lack of a capsule around a neurofibroma tumor
5) There is no phenotypic distinguishing characteristic that differentiates a schwannoma from a neurofibroma.
4) Distinctly differing locations of occurrence along the spinal axis

Nerve sheath tumors account for 25% of intradural spinal cord tumors in adults and can be further broken down into either schwannomas or neurofibromas. Schwannomas are more common than neurofibromas, most commonly occurring in patients 30 to 50 years of age, equally between the sexes. Most schwannomas arise in the dorsal nerve root. Neurofibromas, however, have a predilection to the ventral root. Both tumors primarily are intradural but as many as 10% to 15% can escape through the dura to form a dumbbell shape and exist as both an intradural and extradural tumor. Histologically, fibrous tissue and nerve fibers make up a neurofibroma. Grossly, neurofibromas appear as a fusiform enlargement of the nerve, making a clear distinction between tumor and nerve impossible. Macroscopically, schwannomas look like smooth globoid masses sitting on the nerve fiber and a clear resection plane is apparent.Correct Answer: The presence of a dissection plane between the tissue and a schwannoma tumor

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2587. (2494) Q6-2962:

What is the advantage of performing a magnetic resonance image (MRI) to evaluate spinal tumors:

1) The post-contrast enhancement pattern is sensitive and specific in diagnosing malignant tumors.
3) Magnetic resonance imaging is more sensitive than computed tomography (CT) myelography.
2) The diagnosis is often made based on imaging location of a tumor, thus avoiding the need for invasive tissue diagnosis.
5) Magnetic resonance imaging is a helpful, adjunct diagnostic tool that can elucidate characteristics of spinal cord lesions and help narrow the differential diagnosis.
4) Magnetic resonance imaging has no advantage as a diagnostic tool in evaluating spinal cord lesions.

Although diagnosis and localization of spinal column tumors depends on a patientâs history and physical examination, differentiation of intramedullary versus extramedullary location of a tumor relies primarily on image findings. The most common imaging modality is MRI. Lesion signal abnormalities, cerebral spinal fluid (CSF) capping, and cord or cauda equina displacement signify extramedullary masses, even without contrast. Gadolinium enhancement increases the sensitivity of the MRI, as almost all spinal cord tumors demonstrate some contrast enhancement. Although more sensitive than MRI, myelography and postmyelography CT are rarely used initially due to their invasive nature.Correct Answer: Magnetic resonance imaging is a helpful, adjunct diagnostic tool that can elucidate characteristics of spinal cord lesions and help narrow the differential diagnosis.

2588. (2495) Q6-2964:

A 54-year-old man presents with low back pain and lower extremity weakness. Imaging shows a solitary lesion located in the conus medullaris with enhancement after administration of gadolinium. The most likely diagnosis is:

1) Epidermoid cyst
3) Meningioma
2) Lymphoma
5) Astrocytoma
4) Ependymoma

Ependymomas are the most common intramedullary tumor in adults and are found with equal prevalence in middle-aged men and women. They are most prevalent in the caudal regions of the spinal cord around the conus medullaris and filum terminale. Epidermoid cysts and dural-based meningiomas are extramedullary tumors. Astrocytomas are most commonly found in the lower cervical region, and a patient presents with neck pain and upper extremity deficits.Correct Answer: Ependymoma

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2589. (2496) Q6-2965:

Which of the following diagnostic modalities is used most often to evaluate suspected malignant astrocytomas of the spinal cord:

1) History and physical examination is often sufficient to make the diagnosis.
3) Malignant astrocytoma of the spinal cord is a clinical diagnosis and is only confirmed after post-mortem tissue evaluation.
2) Imaging characteristics of malignant astrocytomas on magnetic resonance imaging (MRI) are specific enough to make the diagnosis.
5) Computed tomography with a myelogram
4) An open biopsy with tissue evaluation is the only way to make the diagnosis.

Clinically, early symptoms of intramedullary tumors are nonspecific. Almost all intramedullary tumors show contrast uptake. Even though there are specific MRI characteristics to each tumor, enough variability and overlap exists in their radiologic appearance that histological examination is still required for definitive diagnosis.Correct Answer: An open biopsy with tissue evaluation is the only way to make the diagnosis.

2590. (2497) Q6-2966:

The most effective treatment for malignant intramedullary tumors of the spinal cord is:

1) Surgical excision
3) Chemotherapy
2) Radiation therapy
5) Neither a single treatment modality nor a combination of treatment modalities has proven effective in significantly improving mortality.
4) Surgical excision followed by a combination of chemotherapy and radiation therapy.

Despite treatment, a poor prognosis is given to patients with malignant intramedullary tumors. The median survival time for patients with cervical tumors is 3 to 6 months. Surgical excision, radiation, and chemotherapy are not found to significantly improve survival. Treatment is generally supportive.Correct Answer: Neither a single treatment modality nor a combination of treatment modalities has proven effective in significantly improving mortality.

2591. (2498) Q6-2967:

Initially, the most appropriate method to evaluate a patient with suspected peripheral nerve injury involves:

1) An imaging study, preferably magnetic resonance imaging (MRI), of the injured region
3) A doppler ultrasound to study blood flow to the injured area
2) Electromyography and nerve conduction velocity studies
5) A detailed neurologic evaluation noting distal motor function
4) An MRI of the entire spine to evaluate possible spinal cord injury

After a traumatic injury to peripheral nerves, early clinical examination is imperative. The key is to test for motor function in the most distal aspect of the nerve and be able to localize the site of injury. Imaging studies are far less sensitive than clinical examinations. Electromyography and nerve conduction velocity studies are usually performed during the follow-up examination to assess for residual, or recovery of, function.Correct Answer: A detailed neurologic evaluation noting distal motor function

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2592. (2499) Q6-2969:

The type of peripheral nerve injury that requires acute repair is:

1) A sharp transection
3) A contusion injury
2) A blunt transection
5) No peripheral nerve injury should be acutely repaired.
4) A stretch injury

The type of traumatic peripheral nerve injury dictates the timing of repair. If a nerve has been sharply transected, then repair should be performed within 72 hours. This can be accomplished during the repair of associated skin, vessels, muscles, and tendons. For a sharply transected but partially cut nerve, early repair is also recommended. Bluntly transected nerves require delayed repair. Contusion and stretch injuries may require delayed surgery.Correct Answer: A sharp transection

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2593. (2500) Q6-2970:

The proper treatment plan for contusion and stretch peripheral nerve injuries involves:

1) Immediate surgical exploration and repair
3) Immediate surgical exploration followed by delayed repair weeks to months later
2) Delayed surgical repair 2 weeks after injury
5) Observation followed by delayed surgical exploration if no functional recovery is found
4) Observation only

For contusion and stretch peripheral nerve injuries, delayed surgery is recommended. Patients are followed for several weeks to months and monitored for functional nerve recovery. If there is no evidence of regeneration, then surgical exploration is performed.Correct Answer: Observation followed by delayed surgical exploration if no functional recovery is found

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2594. (2501) Q6-2971:

The most common type(s) of peripheral nerve injury is:

1) A sharp laceration injury
3) Contusion and stretch injuries
2) A blunt laceration injury
5) Traumatic peripheral nerve injuries occur with approximately the same frequency.
4) A proximal root avulsion

The most common types of traumatic nerve injuries are contusion and stretch injuries. A severe blow to soft tissues or even a fracture can cause a contusion. Gunshot wounds, for example, may produce contusion injuries. Stretch injuries usually result from extreme movements of the limbs, most commonly the shoulder joint with involvement of the brachial plexus.Correct Answer: Contusion and stretch injuries

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2595. (2502) Q6-2972:

Which of the following is the anatomic origin of the Brown-Sequardâs syndrome:

1) Ischemic damage to the periphery of the cord
3) Contusion to the dorsal cord
2) Shear injury to the central cord
5) Complete transection of the cord
4) Traumatic hemisection of the cord

Brown-Sequardâs syndrome often results from penetrating wounds that cause anatomical hemisection of the cord. Shear injury to the central cord usually results in the central cord syndrome. Contusions to the spinal cord lead to level-specific and long-tract findings depending on the location of contusion. Complete transsection leads to complete neurologic loss.Correct Answer: Traumatic hemisection of the cord

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2596. (2503) Q6-2973:

Which of the following is the most common cause of and the treatment for conus medullaris syndrome:

1) Traumatic injury treated with steroids
3) Chronic metabolic treated by correcting the underlying cause
2) Ischemic injury treated by medical management
5) Idiopathic, no treatment is needed
4) Compressive lesion treated by surgical decompression

Conus medullaris syndrome is caused by upper and lower motor neuron injury because of a combined spinal cord and nerve root injury caused by thoracolumbar injuries (levels between T-11 and L-1). Causative agents are compressive in nature such as a compression fracture or herniated disk. Treatment is emergent surgical decompression. The prognosis is better for incomplete injuries.Correct Answer: Compressive lesion treated by surgical decompression

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2597. (2504) Q6-2974:

Which of the following is the most important prognostic sensory modality during examination of a patient with a spinal cord injury:

1) Pain and temperature sensation carried by the spinothalamic tracts
3) Joint position carried by the spinocerebellar tract
2) Light touch and joint position carried by the dorsal column tracts
5) Sensory examination has no prognostic value in evaluation of spinal cord injury patients
4) All modalities carry the same prognostic value

The most important prognostic sensory modalities are those carried in the lateral spinothalamic tract rather than dorsal columns.Correct Answer: Pain and temperature sensation carried by the spinothalamic tracts

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2598. (2505) Q6-2976:

Which of the following is the time window from the time of injury during which treatment of nonpenetrating spinal cord injury with methylprednisolone is indicated:

1) 2 hours
3) 8 hours
2) 4 hours
5) 24 hours
4) 12 hours

Administration of methylprednisolone within 8 hours of injury provides benefit to patients with spinal cord injury. Treatment of patients arriving after 8 hours of treatment has been shown to worsen morbidity. Therefore, patients arriving at trauma centers within this time receive methylprednisolone treatment as part of the standard of care. The exception is the group of patients with penetrating spinal cord injuries where the risk of treatment outweighs the potential benefits.Correct Answer: 8 hours

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2599. (2596) Q6-3069:

Pain from a herniated lumbar disk is caused by:

1) Rupture of the thecal sac
3) Ischemia and potential necrosis of the nerve root
2) Local instability due to a ruptured nucleus pulposus
5) Herniated nucleus pulposus and the resulting local inflammation
4) Associated spinal stenosis

The annulus is composed of alternating laminae that are primarily composed of type I and type II collagen. The annulus is thinnest posterolaterally and thickest anteriorly. As the disk is loaded, the nucleus transfers axial loads to the annulus in the form of hoop stresses. With degenerative or traumatic processes, fissures or tears may develop in the annulus and the nucleus can become herniated.

A herniated nucleus pulposus is a foreign material to the surrounding structures. The combination of mechanical pressure on a nerve root and local inflammation can lead to neurologic signs and symptoms.

Correct Answer: Herniated nucleus pulposus and the resulting local inflammation

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2600. (2597) Q6-3070:

The term Schmorlâs nodule refers to:

1) A giant synovial cyst
3) A pathologic dorsal root ganglion
2) An enlarged paravertebral lymph node
5) Anterior displacement of an intervertebral disk
4) Superior or inferior displacement of an intervertebral disk

Superior and inferior displacements into the vertebral body are known as Schmorlâs nodules.Correct Answer: Superior or inferior displacement of an intervertebral disk

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2601. (2598) Q6-3072:

A far lateral herniated nucleus pulposus at the L4-L5 level would lead to signs and symptoms of which nerve root on the affected side:

1) L3
3) L5
2) L4
5) None of the above
4) S1

A far lateral herniated nucleus pulposus, which is less common, can lead to compression of the nerve root that has already exited the supra-adjacent foramen. Therefore, a far lateral L4-L5 herniated nucleus pulposus leads to L4 nerve root compression.Correct Answer: L4

2602. (2599) Q6-3073:

A sequestered disk herniation refers to:

1) Bulging of the nucleus through a weakened annulus
3) Rupture of the nucleus through the annulus and the posterior longitudinal ligament
2) Rupture of the nucleus through the annulus
5) Separation of a herniated fragment from the disk
4) Rupture of the nucleus through the posterior longitudinal ligament

A sequestered herniation is a separation of a herniated fragment from the disk from which it came.Correct Answer: Separation of a herniated fragment from the disk

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2603. (2600) Q6-3074:

Common presentations of cauda equina syndrome include:

1) Severe low back pain with nausea and vomiting
3) Progressive chronic low back pain radiating to the gluteal region
2) Acute onset unilateral foot drop
5) Fever, photophobia, and nuchal rigidity
4) Saddle anesthesia and bowel and/or bladder dysfunction

In patients with suspected central herniated nucleus pulposus, cauda equina syndrome must not be missed as it could cause irreversible neurological damage. Cauda equina syndrome presents with saddle anesthesia and bowel or bladder changes.Correct Answer: Saddle anesthesia and bowel and/or bladder dysfunction

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2604. (2601) Q6-3075:

Which of the following statements is true regarding the natural history of a herniated lumbar disk:

1) The natural history of a herniated lumbar disk is usually consistent with approximately 90% spontaneous resolution without intervention by 3 monthsâ follow-up.
3) Despite aggressive surgical correction, permanent neurological deficits are common.
2) Surgical intervention is often required for definitive and long-term treatment.
5) The natural history of lumbar disk herniations has not been studied.
4) Surgical diskectomy is a contraindication in patients with neurologic deficit.

A period of rest is prescribed for 1 to 2 days with supports under the knees and neck to minimize root tension. Also, nonsteroidal anti-inflammatory drugs are used. Prolonged bed rest is no longer advocated because it can lead to deconditioning of compensatory musculature. Ambulation is begun as tolerated after the first few days of an acute event. More than one-half of patients who initially present with low back pain recover within 1 week and more than 90% of patients recover in 1 to 3 months. Physical therapy is started as tolerated.Correct Answer: The natural history of a herniated lumbar disk is usually consistent with approximately 90% spontaneous resolution without intervention by 3 monthsâ follow-up.

2605. (2602) Q6-3076:

Long-term follow-up studies of surgical versus conservative treatment of herniated lumbar disks indicate:

1) Conservative management yields better long-term outcome.
3) No statistically significant difference in outcome is noted despite the type of treatment used.
2) Surgical intervention has better long-term results.
5) None of the above
4) No long-term data are available.

The prognosis of herniated lumbar disks is generally good regardless of treatment. Patients operated on for proven disk herniations improved more rapidly than patients treated nonoperatively. However, within 4 to 5 years, the outcomes begin to approximate each other.Correct Answer: No statistically significant difference in outcome is noted despite the type of treatment used.

2606. (2603) Q6-3078:

The predominant cause of low back pain in the general population, aside from the general sprain and strains of the paraspinal structures, is attributed to:

1) Spondylolisthesis
3) Spinal stenosis
2) Herniated nucleus pulposus
5) Vascular insufficiency
4) Degenerative disk disease

The consequences of normal aging of the spine include progressive disk dehydration, chemical alterations and subsequent mechanical âincompetenceâ of the intervertebral disk, which may be manifested in low back pain, although an exact correlation between disk degeneration and low back pain has not been established. Nevertheless, many believe that the predominant cause of persistent low back pain is degeneration of the disk.Correct Answer: Degenerative disk disease

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2607. (2604) Q6-3079:

Initial work-up of an otherwise healthy individual with acute onset low back pain should include:

1) A complete history, physical examination, and follow-up imaging studies only if indicated
3) A magnetic resonance imaging study of the lumbar spine
2) A complete history, physical examination, and plain radiographs
5) No evaluation is needed on initial visit as most low back pain resolves spontaneously
4) A computed tomography of the lumbar spine

All patients presenting with back pain should have a thorough history taken and a complete physical exam including a detailed neurologic exam. In the recently published Agency for Health Care Policy and Research Clinical Practice Guideline on Acute Low Back Pain Problems in Adults, it was concluded that a focused physical exam was sufficient to assess a patient with acute or recurrent low back pain of fewer than 4 weeks duration, unless findings suggested an underlying tumor, or an infectious, a traumatic or a major neurologic syndrome.Correct Answer: A complete history, physical examination, and follow-up imaging studies only if indicated

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2608. (2605) Q6-3080:

A 72-year-old man with acute onset low back pain with increased severity during the night should be evaluated by:

1) History and physical examination only
3) History, examination, and urine protein electrophoresis
2) Magnetic resonance imaging of the lumbar spine
5) Plain radiographs of the lumbar spine
4) Computed tomography of the lumbar spine

An elderly patient with unsolicited low back pain is suggestive of a primary malignancy or metastatic disease of the lumbar spine. A thorough history and physical examination are indicated, as well as imaging to evaluate the lumbar spinal axis and the neural elements.Correct Answer: Magnetic resonance imaging of the lumbar spine

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2609. (2606) Q6-3082:

An otherwise healthy 56-year-old patient with suspected spinal stenosis after history and physical examination undergoes plain radiography that is unremarkable for spondylolisthesis. The next feasible imaging modality that is indicated in aiding the diagnosis is:

1) No more imaging studies are needed
3) Magnetic resonance imaging
2) A computed tomography myelogram
5) Spinal angiogram
4) Ultrasound

Although a computed tomography myelogram is slightly more specific and sensitive than magnetic resonance imaging (MRI) in evaluating lumbar stenosis, MRI is almost as sensitive and it is noninvasive. Therefore, in an otherwise healthy patient without contraindications, an MRI should be considered as the next imaging modality.Correct Answer: Magnetic resonance imaging

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2610. (2607) Q6-3083:

Untreated low back pain most commonly:

1) Improves spontaneously
3) Leads to neurological decompensation
2) Undergoes progressive worsening prompting further medical care
5) Progresses to chronic failed back syndrome
4) No studies have been done to evaluate the natural history of untreated low back pain.

Generally, patients diagnosed with low back pain should undergo 4 weeks of conservative treatment with an accepted prognosis of predominantly spontaneous improvement over a 4-week period, regardless of treatment.Correct Answer: Improves spontaneously

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2611. (2608) Q6-3084:

Which of the following is NOT a routinely used imaging modality for evaluation of spinal pathology:

1) Plain radiography
3) Magnetic resonance imaging
2) Computed tomography
5) Myelogram
4) Diskography

Diskography is a diagnostic technique that has been used since the 1950âs. The study involves injection of dye into an intervertebral disk space. A positive study is one in which the injected dye is not contained within the disk space or in which the injection reproduces the characteristic distribution of the patientâs pain. The current role of diskography remains undefined and, at this time, diskography is not a first-line diagnostic study in the evaluation of patients with low back pain.Correct Answer: Diskography

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2612. (2609) Q6-3085:

Which of the following is the most common type of spondylolisthesis seen in the adult population:

1) Degenerative
3) Congenital
2) Isthmic
5) Pathologic
4) Traumatic

The prevalence of degenerative spondylolisthesis is 2% to 5%; the prevalence increases with age. Symptomatic patients usually present in the fourth decade of life or later. The disease is five times more common in the female sex. The African American population, diabetics, and patients with sacralization of the L5 vertebrae are also at increased risk for developing symptomatic spondylolisthesis.Correct Answer: Degenerative

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2613. (2610) Q6-3086:

Which of the following is the most common location of adult degenerative spondylolisthesis:

1) L1-L2 interspace
3) L3-L4 interspace
2) L2-L3 interspace
5) L5-S1 interspace
4) L4-L5 interspace

The L4-L5 interspace is the most common location of adult degenerative spondylolisthesis.Correct Answer: L4-L5 interspace

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2614. (2611) Q6-3088:

Which of the following statements is true regarding the initial diagnostic radiographic evaluation of patients with spondylolisthesis:

1) Initial diagnostic radiographic evaluation includes plain radiographic imaging of lumbar spine with flexion and extension.
3) Spondylolisthesis is a clinical diagnosis; no imaging studies are indicated.
2) Computed tomography of the lumbar spine region is the first order diagnostic imaging study.
5) If spondylolisthesis is suspected, myelogram is necessary for diagnosis.
4) Initial diagnostic radiographic evaluation includes magnetic resonance imaging of the lumbar spine to evaluate spinal stenosis and nerve root compression.

Plain radiographs should be performed in a standing position as some cases of spondylolisthesis can be missed if x-rays are taken in a supine position. Forward displacement of L4 on L5 and more rarely L5 on S1 or L3 on L4, without a pars interarticularis defect is often demonstrated. Other radiologic findings of osteophyte formation, such as disk-space narrowing, endplate sclerosis, vacuum disk sign, facet sclerosis and hypertrophy, are consistent with long-standing degenerative disease. Hemisacralization of L5 may be revealed. Flexion, extension, and lateral bending films often reveal hypermobility.Correct Answer: Initial diagnostic radiographic evaluation includes plain radiographic imaging of lumbar spine with flexion and extension.

2615. (2612) Q6-3089:

Initial nonoperative management of adult degenerative spondylolisthesis includes all of the following except:

1) Physical therapy
3) Modified activity
2) Anti-inflammatory medication
5) Support brace
4) Strict bed rest

Conservative treatment for degenerative spondylolisthesis is consistent with the conservative care of most degenerative spinal disorders. It includes modified activity, physical therapy (conditioning exercises emphasizing lumbar flexion and progression to aerobic conditioning), anti-inflammatory medication, and sometimes spinal support with a corset or light-weight brace.Correct Answer: Strict bed rest

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2616. (2613) Q6-3090:

Which of the following statements is true regarding lumbar degenerative scoliosis:

1) Lumbar degenerative scoliosis is most commonly distributed to the left.
3) Lumbar degenerative scoliosis is most commonly evenly distributed between left and right.
2) Lumbar degenerative scoliosis is most commonly distributed to the right.
5) No data are available.
4) The distribution of lumbar degenerative scoliosis depends on age of patient at the time of onset.

Degenerative lumbar scoliosis occurs in approximately the same number of women as men. Lumbar curves are generally smaller than those in idiopathic scoliosis and are more evenly distributed between left and right, also in contrast to idiopathic curves that occur predominantly to the left.Correct Answer: Lumbar degenerative scoliosis is most commonly evenly distributed between left and right.

2617. (2614) Q6-3091:

Which of the following is the most common complaint in patients with degenerative lumbar scoliosis:

1) Radicular pain radiating to one or the other leg
3) Low back pain and reduced tolerance for walking
2) Mechanical pain during motion
5) Sensory changes at the dorsal feet bilaterally
4) Urinary incontinence

Patients with degenerative lumbar scoliosis typically complain of symptoms related to the associated spinal stenosis. These symptoms commonly include (with approximate incidence rates): low back pain (100%), reduced tolerance for standing and walking (85% to 100%), neurogenic claudication (50%), and radicular or pseudoradicular pain radiating into the buttocks or thighs (40% to 60%).Correct Answer: Low back pain and reduced tolerance for walking

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2618. (2615) Q6-3095:

Bony contribution to the lumbar lordotic curvature is provided by:

1) Spinous processes
3) Lamina
2) Articulating facets
5) Vertebral body
4) Pars interarticularis

The anterior portion of each body has a slightly increased height that contributes to the sagittal lumbar lordosis. The posterior vertebral arch consists of the paired pedicles, laminae, and a midline dorsal spinal process.Correct Answer: Vertebral body

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2619. (2616) Q6-3096:

Superior articulating facets in the lumbosacral spine differ from those in the thoracic spine because facets in the lumbosacral spine:

1) Face posteriorly
3) Have a thicker facet joint capsule
2) Face dorsomedially
5) Are fused and are not true joints
4) Face superolaterally

The paired superior articular facets are directed dorsomedially with their corresponding inferior articular processes directed ventrolaterally. These diarthrodial articulations possess thin, lax joint capsules capable of a limited gliding articulation between adjoining vertebrae. They permit flexion, lateral bending and extension, but resist rotation due to both size and facet orientation. The facets alone can bear up to 18% of the compressive load.Correct Answer: Face dorsomedially

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2620. (2617) Q6-3098:

Limitation of hyperextension in the lumbosacral spine is controlled by the:

1) Posterior longitudinal ligament
3) Ligamentum flavum
2) Anterior longitudinal ligament
5) Intertransverse ligament
4) Interspinous ligament

More flexion-extension motion occurs in the caudal segments of the lumbar spine than in the upper and middle levels. The well-developed anterior longitudinal ligament and the anterior portion of the annulus fibrosus are important inhibitors of hyperextension.Correct Answer: Anterior longitudinal ligament

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2621. (2618) Q6-3099:

Which of the following is the primitive remnant of the nucleus pulposus:

1) The smoites
3) Midgut
2) Ectoderm
5) Notocord
4) Rhombencephalon

The nucleus pulposus is derived from the primitive notochord. It consists predominantly of hydrated proteoglycans with a minor component of a random network of type I and type II collagen.Correct Answer: Notocord

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2622. (2619) Q6-3102:

Which of the following is the most common region of the spine affected by metastatic disease:

1) Craniocervical junction
3) Thoracic region
2) Cervical region
5) Sacral region
4) Lumbar region

The thoracic spine is the most common site of metastatic disease. This has been attributed to the watershed zone being located in the low thoracic region.Correct Answer: Thoracic region

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2623. (2620) Q6-3103:

Which of the following is the most common complaint at time of presentation in patients with metastatic spine disease:

1) Difficulty with balance
3) Night sweats
2) Difficulty with urination
5) Numbness in the lower extremities
4) Pain during the night

The most common manifestation of metastatic disease is persistent pain. Pain is most marked at night and aggravated by movement. History of trauma is usually absent. Pain is followed by weakness of the lower extremities, sensory loss, and bladder and bowel changes.Correct Answer: Pain during the night

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2624. (2621) Q6-3105:

Which of the following methods is the standard in diagnosing vertebral metastatic disease:

1) Plain radiography demonstrating lytic lesion
3) Magnetic resonance imaging with typical destructive lesion characteristics
2) Computed tomography with bony destruction respecting adjacent vertebral levels
5) There is no standard of care in diagnosing vertebral metastasis.
4) Tissue biopsy

The only definitive method of determining the presence and nature of metastatic tumor is vertebral biopsy. Computed tomography-guided biopsy of the spine provides an accurate access to the lesion. Open biopsy is indicated when image guided biopsy is not feasible or non-diagnostic. Differential diagnosis mainly involves spinal infections, osteoporosis, disk disease, and multiple myeloma.Correct Answer: Tissue biopsy

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2625. (2622) Q6-3106:

Which of the following is NOT an indication for surgical intervention in metastatic vertebral disease:

1) Progressive neurologic deficit
3) Instability of the spine
2) Poor prognosis
5) Failure of radiation therapy
4) Uncontrollable pain

In patients with metastatic vertebral disease, indications for surgery include progressive neurologic deficit, instability of the spine, uncontrollable pain, and failure of radiation therapy. Surgical intervention can add significant morbidity while providing marginal improvement in longevity of a patient with an already poor prognosis.Correct Answer: Poor prognosis

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2626. (2623) Q6-3107:

Which of the following is the most common cause of lumbar stenosis:

1) Congenital
3) Degenerative
2) Posttraumatic
5) Idiopathic
4) Iatrogenic

Degenerative lumbar stenosis is the most common cause of lumbar stenosis. With normal aging of the disk, the water-binding capacity of the nucleus pulposus is dissipated, diminishing its ability to withstand normal compressive and rotational forces. With progressive degeneration of the disk, collapse occurs. This collapse results in overriding of the facet joints and relative lengthening of adjacent capsular and ligamentous structures.

Continued instability, which may be multidirectional, results in hypertrophic changes about the periphery of the vertebral body at its annular attachments. Radiographically, these are seen as traction osteophytes. Similarly, osteophytes form about the facet joints, which lead to compromise of the neural canal. With disease progression, hypertrophic changes predominate, leading to ankylosis and auto stabilization. In patients with less than optimal canal configurations or dimensions or those with excessive hypertrophic degenerative changes, narrowing of the spinal canal, lateral recesses, and neural foramina may result in neurogenic signs and symptoms.

Correct Answer: Degenerative

2627. (2624) Q6-3108:

Which of the following is the most common presentation of a patient with lumbar stenosis:

1) Foot drop
3) Chronic low back pain with neurogenic claudication
2) Acute onset of pain in bilateral lower extremities
5) Intermittent urinary incontinence
4) Saddle anesthesia

The most common complaint in patients with spinal stenosis is chronic low back pain with worsening and lower extremity weakness after ambulation (claudication). Symptoms are often resolved by rest and/or leaning forward.Correct Answer: Chronic low back pain with neurogenic claudication

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2628. (2625) Q6-3110:

Clinical symptoms of lumbar spinal stenosis usually correlate with a canal anteroposterior diameter of less than:

1) 20 mm
3) 10 mm
2) 15 mm
5) There is no correlation.
4) 5 mm

The clinical syndrome of lumbar stenosis correlates with a measured anteroposterior diameter of the dural sac of less than 10 mm.Correct Answer: 10 mm

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2629. (2626) Q6-3112:

Which of the following is the most commonly fractured location along the thoracolumbar axis:

1) The cervicothoracic junction
3) The thoracolumbar region
2) The mid-thoracic region
5) The lumbosacral junction
4) The lumbar region

Up to 60% of spinal injuries occur between the T11 and L1 segments. The rigid thoracic rib cage and coronal orientation of the facets permit lateral bending and rotation but little flexion and extension. The facet joints then transition caudally to a more sagittal orientation in the lumbar spine, allowing increased flexion/extension but limiting lateral motion. These factors create a stress concentration at the thoracolumbar junction, which is demonstrated by the high incidence of injury at the T11 to L1 segments.Correct Answer: The thoracolumbar region

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2630. (2627) Q6-3113:

A 26-year-old man who was involved in a motor vehicle accident is found to have a T12 compression fracture on plain radiography without evidence of posterior extrusion. The likelihood of finding another fracture in the spinal axis with further evaluation is:

1) Highly remote, these fractures are usually isolated
3) 50% to 75%
2) 10% to 15%
5) The incidence of noncontiguous-associated fractures in the spine is not known.
4) A low thoracic fracture is almost always associated with another fracture in the spine.

A thorough workup in these patients is essential; approximately 10% to 15% of patients will have noncontiguous injuries located elsewhere in the spine.Correct Answer: 10% to 15%

2631. (2628) Q6-3114:

Based on the three-column model of spinal stability, an unstable spinal injury is defined as:

1) An injury that disrupts no less than all three columns
3) Disruption of more than one column
2) Disruption of any of the three columns is considered unstable.
5) The three-column model of injury is not a reliable marker of instability.
4) Disruption of all three columns plus neurological injury

The three-column spine consists of the anterior, middle, and posterior columns. In this widely used classification system, the middle column is the key to instability. If the middle column is disrupted, in addition to either the anterior or posterior columns, then instability results.Correct Answer: Disruption of more than one column

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2632. (2629) Q6-3115:

Burst fractures of the vertebral body require prompt evaluation because:

1) Although burst fractures of the vertebral body are stable injuries, neurologic deterioration is likely.
3) Burst fractures of the vertebral body are extremely painful to the patient.
2) Burst fractures of the vertebral body involve two-column injury and are unstable.
5) Burst fractures of the vertebral body often result in spinal shock.
4) Burst fractures of the vertebral body are commonly associated with other noncontiguous fractures.

When the middle column is involved in a compression injury, it is classified as a burst fracture. This involves axial load on the spine, with or without a flexion component, and retropulsion of the posterosuperior vertebral body into the spinal canal, thus requiring prompt medical attention. Neurologic deficit is variable and is related to the severity of the initial injury and location of the fracture, and only loosely related to the percent of canal compromise.Correct Answer: Burst fractures of the vertebral body involve two-column injury and are unstable.

2633. (2630) Q6-3116:

Compression fractures of the spine, although typically considered a one-column injury, can be unstable. Findings at time of presentation suggestive of an unstable fracture include:

1) Pain out of proportion to the physical examination
3) Initial kyphosis greater than 20Â° to 30Â°
2) Radiographic findings of more than one compression fracture
4) Loss of less than 50% of anterior vertebral body height

Compression fractures are inherently stable and may be treated with extension bracing or casting. If, however, the flexion injury is severe enough, damage to the posterior ligaments can result and the injury becomes unstable. Criteria for this instability were developed by McAfee and include more than 20Â° to 30Â° of initial kyphosis or more than 50% loss of anterior vertebral height, applicable to both compression and burst fractures.Correct Answer: Initial kyphosis greater than 20Â° to 30Â°

2634. (2631) Q6-3117:

Which of the following is the most important factor responsible for a decreasing proportion of patients with complete paraplegia after sustaining a spinal cord injury today compared with four decades ago:

1) Improvements in rehabilitative measures
3) New and novel medication therapy
2) Advances in operative techniques and instrumentation
5) Better initial triage, resuscitation, and clinical management of patients
4) Higher patient motivation and participation in therapy and rehabilitation

Improvements in the initial triage, resuscitation, and clinical management of spinal cordâ injured patients are likely responsible for a decreasing proportion of patients with complete paraplegia. Currently, approximately 45% of spinal cordâinjured patients have a complete injury, as opposed to two-thirds four decades ago.Correct Answer: Better initial triage, resuscitation, and clinical management of patients

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2635. (2632) Q6-3118:

Based on the current consensus on treatment of acute spinal cord injury, intravenous steroid treatment is considered to have potential benefit if begun within how many hours of original injury:

1) 3
3) 8
2) 5
5) 24
4) 12

The results of the National Acute Spinal Cord Injury Study II (NASCIS II) demonstrated significant motor and sensory improvement in patients who were treated within 8 hours of injury with a methylprednisolone bolus of 30 mg/kg, followed by an infusion of 5.4 mg/kg per hour for 24 hours.Correct Answer: 8

2636. (2633) Q6-3119:

A 73-year-old woman with a history of cervical stenosis who sustained a fall at home yesterday is now complaining of âclumsyâ fingers and weakness in her hands. She denies any difficulty with ambulation or bowel and bladder dysfunction. She most likely has:

1) Bilateral cervical radiculopathy
3) Anterior cord syndrome
2) Exacerbation of cervical stenosis
5) Central cord syndrome
4) Posterior cord syndrome

The most common incomplete spinal cord injury syndrome is most likely central cord syndrome. Central cord syndrome often occurs as a result of a pinching of the spinal cord in elderly patients who have a narrowed spinal canal as the result of degenerative spondylosis. It is a pattern of disproportionately severe upper extremity motor and sensory changes as compared to lower extremity findings.Correct Answer: Central cord syndrome

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2637. (2634) Q6-3120:

A 27-year-old man was involved in a motor vehicle accident. He was resuscitated at the scene but was noted to have a prolonged hypotensive period. Upon arrival at the medical center, he is noted to be paraplegic but radiographic evaluation does not demonstrate any fracture or soft tissue abnormality. Which of the following is the most likely diagnosis:

1) Occult fracture with retropulsion into the cord
3) Spinal shock
2) Contusion of the cord at a high thoracic level
5) Conversion disorder
4) Spinal cord ischemic injury at the low thoracic watershed zone

A watershed zone refers to an area that is supplied purely by end arteries. Therefore, during periods of hypoperfusion, it is the most likely region to sustain an ischemic injury. In the spinal cord, this region lies in the T7-T9 region as it is a watershed zone between the rostral anterior spinal artery distribution and the caudal dominant lumbar segmental artery.Correct Answer: Spinal cord ischemic injury at the low thoracic watershed zone

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2638. (2635) Q6-3121:

The watershed zone of the spinal cord most closely correlates with which region of the spinal cord:

1) C5-C7
3) T7-T9
2) T4-T6
5) L3-L5
4) T11-L1

A watershed zone refers to an area that is supplied purely by end arteries. Therefore, during periods of hypoperfusion, it is the most likely region to sustain an ischemic injury. In the spinal cord, this region lies in the T7-T9 region as it is a watershed zone between the rostral anterior spinal artery distribution and the caudal dominant lumbar segmental artery.Correct Answer: T7-T9

2639. (2659) Q6-3152:

Which of the following is the most common source of infection in vertebral osteomyelitis:

1) Trauma
3) Hematogenous spread
2) Iatrogenic
5) Unknown mechanism
4) Spontaneous

Hematogenous seeding from another primary source is the most common causative agent. Hematogenous spread of infections is believed to affect the spine via septic emboli in the endarteriolar circulation of segmental spinal arteries at the vertebral endplates. The majority of cases of pyogenic spondylitis begin in the subchondral, metaphyseal region of the anterior subligamentous portion of the vertebral body â the portion with the greatest arterial supply and the most anastomoses.Correct Answer: Hematogenous spread

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2640. (2660) Q6-3153:

Which of the following is the most common location of vertebral osteomyelitis along the spinal axis:

1) Craniocervical junction
3) Lumbar spine
2) Thoracic spine
5) Cervical spine
4) Sacral spine

Lumbar spine is the most common region of the spine affected by hematogenous spread of organisms leading to osteomyelitis followed by the thoracic spine.Correct Answer: Lumbar spine

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2641. (2661) Q6-3154:

Which of the following is the most common organism identified in cases of vertebral osteomyelitis:

1) *Staphylococcus aureus*
3) *Haemophilus influenzae*
2) *Streptococcus pneumoniae*
5) Anaerobic gram-negative rods
4) *Escherichia coli*

Staphylococcus aureus remains the most common causative organism, but an increasing proportion of cases are due to gram-negative and anaerobic organisms such as *Proteus, Escherichia coli* and *Pseudomonas*.Correct Answer: *Staphylococcus aureus*

2642. (2662) Q6-3155:

Which of the following is the most common presentation of vertebral osteomyelitis:

1) Fever of unknown origin
3) Unrelenting back pain not relieved by rest
2) Lower extremity pain and weakness
5) None of the above. It is usually an incidental finding during an unrelated work-up.
4) Urinary incontinence

The most common presenting sign of vertebral osteomyelitis is back pain and malaise, often of 3 monthsâ duration or greater. It is often well localized to the affected level and the nature is not unlike most degenerative spinal conditions. A high index of suspicion is essential to make a timely diagnosis. Back pain that awakens a patient at night is a hallmark of infection or tumor. Pain associated with infection tends to be relentless and not related to activity level. Most patients have percussion tenderness over the involved segments. Fevers are noted in fewer than half of patients.Correct Answer: Unrelenting back pain not relieved by rest

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2643. (2663) Q6-3156:

Which of the following is the hallmark distinguishing feature of vertebral osteomyelitis when compared to a neoplastic process on imaging:

1) Uniform enhancement after administration of gadolinium in the neoplasia
3) Lack of endplate involvement in the neoplastic process
2) Destruction of disk space and encroachment of adjacent vertebral body in vertebral osteomyelitis
5) There are no distinguishing radiographic features between vertebral osteomyelitis and a tumor.
4) Evidence of a compression fracture in vertebral osteomyelitis

The crossing of the infectious process along the disk space to involve adjacent vertebrae is a hallmark feature of osteomyelitis used to differentiate it from a neoplastic process.Correct Answer: Destruction of disk space and encroachment of adjacent vertebral body in vertebral osteomyelitis

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2644. (2664) Q6-3157:

Which of the following is the imaging modality of choice with the highest relative sensitivity and specificity in patients with suspected vertebral osteomyelitis:

1) Plain radiography
3) Magnetic resonance imaging with contrast administration
2) Computed tomography with contrast administration
5) Vertebral osteomyelitis is primarily a clinical diagnosis
4) Post myelogram computed tomography

Magnetic resonance imaging (MRI) is the modality of choice for spinal infections. An MRI study provides excellent visualization of the neural elements and can determine whether the inflammatory process extends beyond the margins of disk and bone. MRI also provides excellent regional anatomic information. Scans performed with and without intravenous gadolinium are diagnostic in 90% to 95% of cases.Correct Answer: Magnetic resonance imaging with contrast administration

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2645. (2665) Q6-3158:

Neurogenic shock is defined as:

1) Decreased cardiac output due to increased parasympathetic tone
3) Widespread gram-negative septicemia with hypoperfusion
2) Severe volume depletion leading to hypotension
5) Increased cardiac output due to decreased parasympathetic tone
4) Loss of sympathetic tone and widespread vasodilation

Neurogenic shock is a unique hemodynamic alteration in patients with spinal cord injuries who have their sympathetic outflow disrupted in addition to the interruption of the motor and sensory pathways. The loss of sympathetic tone to the heart and peripheral vasculature leads to bradycardia and hypotension.Correct Answer: Loss of sympathetic tone and widespread vasodilation

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2646. (2694) Q6-3188:

The normal range of thoracic kyphosis is:

1) 0Â° to 10Â°
3) 20Â° to 50Â°
2) 5Â° to 20Â°
5) 40Â° to 60Â°
4) 35Â° to 50Â°

The normal range of thoracic kyphosis is 20Â° to 50Â°. The mean in normal adults is 35Â°. The normal range of lumbar lordosis is 40Â° to 80Â°. The mean in normal adults is approximately 60Â°.

The spine is usually straight in the sagittal plane between T10 and L2. The majority of lumbar lordosis occurs between L4 and S1.

Correct Answer: 20Â° to 50Â°

2647. (2695) Q6-3189:

The normal range of lumbar lordosis is:

1) 0Â° to 10Â°
3) 20Â° to 50Â°
2) 10Â° to 20Â°
5) 60Â° to 90Â°
4) 40Â° to 80Â°

The normal range of thoracic kyphosis is 20Â° to 50Â°. The mean in normal adults is 35Â°. The normal range of lumbar lordosis is 40Â° to 80Â°. The mean in normal adults is approximately 60Â°.

The spine is usually straight in the sagittal plane between T10 and L2. The majority of lumbar lordosis occurs between L4 and S1.

Correct Answer: 40Â° to 80Â°

2648. (2696) Q6-3190:

Which of the following regions of the spine is normally straight:

1) T1 to T6
3) T10 to L2
2) T7 to T12
5) T12 to S1
4) L1 to L4

The normal range of thoracic kyphosis is 20Â° to 50Â°. The mean in normal adults is 35Â°. The normal range of lumbar lordosis is 40Â° to 80Â°. The mean in normal adults is approximately 60Â°.

The spine is usually straight in the sagittal plane between T10 and L2. The majority of lumbar lordosis occurs between L4 and S1.

Correct Answer: T10 to L2

2649. (2697) Q6-3191:

The endplates and pedicles of which of the following vertebra are normally parallel to the ground in a standing individual:

1) L1
3) S1
2) L3
5) T12
4) T1

The alignment of the spine is important in normal upright posture. There is a normal degree of lordosis in the cervical and lumbar spines and a moderate degree of kyphosis in the thoracic spine. The head, spine, and pelvis are connected and balanced. If the spine is out of balance, then a deformity can develop causing fatigue of the paraspinal muscles.

The normal sagittal alignment in the upright patient is as follows:

- Plumb line

  The sagittal plumb line falls from the odontoid process through the C7-T1 intervertebral disk and then anterior to the thoracic spine. The plumb line then crosses the spine at the T12-L1 intervertebral disk, and then travels posterior to the spine. The plumb line crosses at the posterior corner of the S1 vertebra.

The endplates and pedicles of the L3 vertebra are normally parallel to the ground.

Correct Answer: L3

2650. (2698) Q6-3192:

Which of the following is true regarding the alignment of the spine with aging:

1) Thoracic kyphosis decreases; lumbar lordosis increases
3) Thoracic kyphosis increases; lumbar lordosis decreases
2) Thoracic kyphosis decreases; lumbar lordosis decreases
5) The alignment of the spine undergoes no significant changes with aging.
4) Thoracic kyphosis increases; lumbar lordosis increases

The normal range of thoracic kyphosis is 20Â° to 50Â°. The mean in normal adults is 35Â°. The normal range of lumbar lordosis is 40Â° to 80Â°. The mean in normal adults is approximately 60Â°.

The spine is usually straight in the sagittal plane between T10 and L2. The majority of lumbar lordosis occurs between L4 and S1.

With aging, due to changes in the intervertebral disks, thoracic kyphosis increases and lumbar lordosis increases. There is loss of height of the intervertebral disks.

Correct Answer: Thoracic kyphosis increases; lumbar lordosis increases

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2651. (2699) Q6-3193:

In reference to the normal sagittal vertical axis (sagittal plumb line), the axis normally falls from the odontoid process through the C7-T1 intervertebral disk and anterior to the thoracic vertebra. This normal axis crosses the spinal column at which of the following levels before crossing the spinal column at the posterior superior border of the S1 vertebral body:

1) T3-T4 intervertebral disk
3) T8-T10 intervertebral disk
2) T6-T7 intervertebral disk
5) L3-L4 intervertebral disk
4) T12-L1 intervertebral disk

The alignment of the spine is important in normal upright posture. There is a normal degree of lordosis in the cervical and lumbar spines and a moderate degree of kyphosis in the thoracic spine. The head, spine, and pelvis are connected and balanced. If the spine is out of balance, then a deformity can develop causing fatigue of the paraspinal muscles.

The normal sagittal alignment in an upright patient is as follows:

- Plumb line

  The sagittal plumb line falls from the odontoid process through the C7-T1 intervertebral disk and then anterior to the thoracic spine. The plumb line then crosses the spine at the T12-L1 intervertebral disk, and then travels posterior to the spine. The plumb line crosses at the posterior corner of the S1 vertebra

The endplates and pedicles of the L3 vertebra are normally parallel to the ground.

Correct Answer: T12-L1 intervertebral disk

2652. (2700) Q6-3194:

The vertebral artery on the right side of the body arises from the subclavian artery and enters the lateral mass foramen of which of the following cervical vertebra (the first one it enters) before ascending to the brain:

1) C3
3) C5
2) C4
5) C7
4) C6

The vertebral artery arises from the subclavian artery on the right side of the body and the aortic arch on the left side. The vertebral artery enters the lateral mass foramen of the sixth cervical vertebra before ascending to the brain.Correct Answer: C6

2653. (2701) Q6-3195:

To avoid damages to the vertebral arteries when exposing the posterior aspect of the first cervical vertebra, dissection should be limited to _____ mm from the midline on the superior aspect of C1 and _____ mm from the midline on the posterior aspect of C1.

1) 8 mm; 12 mm
3) 12 mm; 16 mm
2) 10 mm; 14 mm
5) 16 mm; 22 mm
4) 14 mm; 20 mm

One must be careful not to damage the vertebral artery when exposing the posterior and superior aspect of the C1 vertebra. It is especially important when using a Cobb elevator or an electrocautery not to dissect too far from the midline.

The vertebral artery lies close to the midline. **On the superior aspect, the groove for the vertebral artery lies 8 mm to12 mm from the midline. On the posterior aspect of the vertebral body, the vertebral artery lies 12 mm to 23 mm from the midline.**

Correct Answer: 8 mm; 12 mm

2654. (2702) Q6-3196:

Which of the following levels most significantly contributes to the blood supply of the cervical spinal cord:

1) C2 (accompanying the left C2 spinal nerve)
3) C6 (accompanying the left C6 spinal nerve)
2) C4 (accompanying the right C4 spinal nerve)
5) T1 (accompanying the right T1 spinal nerve)
4) C7 (accompanying the right C7 spinal nerve)

The major blood supply to the cervical spinal cord comes from the anterior spinal artery, which arises from the deep cervical artery. This vessel most commonly accompanies the left C6 spinal nerve.Correct Answer: C6 (accompanying the left C6 spinal nerve)

2655. (2931) Q6-3434:

Patients with Brown-SÃ©quard syndrome usually presents with:

1) Ipsilateral paralysis, loss of contralateral vibration and touch sensation, and loss of ipsilateral pain and temperature sensation
3) Ipsilateral paralysis, loss of ipsilateral vibration and touch sensation, and loss of contralateral pain and temperature sensation
2) Ipsilateral paralysis and loss of contralateral vibration, and touch, pain, and temperature sensation
5) Contralateral paralysis, loss of contralateral vibration and touch sensation, and loss of ipsilateral pain and temperature sensation
4) Contralateral paralysis, loss of ipsilateral vibration and touch sensation, and loss of contralateral pain and temperature sensation

Brown-SÃ©quard Syndrome usually results from hemisection of the spinal cord, which is often a result of trauma (eg, penetrating stab wounds). Clinical presentation usually consists of:

- Ipsilateral paralysis
- Loss of ipsilateral vibration and touch sensation
- Loss of contralateral pain and temperature sensation

Correct Answer: Ipsilateral paralysis, loss of ipsilateral vibration and touch sensation, and loss of contralateral pain and temperature sensation

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2656. (2932) Q6-3435:

Central cord syndrome is typically due to:

1) An axial compression injury with resultant injury to the central gray matter
3) A hyperextension injury with compression of the cord by osteophytes anteriorly and infolded ligamentum flavum posteriorly
2) A hyperextension injury with compression of the cord by herniated disk material anteriorly
5) A hyperflexion injury compression of the cord by the anterior longitudinal ligament anteriorly and osteophytes posteriorly
4) A hyperflexion injury with compression of the cord by herniated disk material anteriorly

Central cord syndrome is the most common incomplete spinal cord lesion and is usually seen in patients with preexisting cervical spondylosis who then sustain a hyperextension injury to the cervical spine. This mechanism causes compression of the cord by osteophytes anteriorly and the infolded ligamentum flavum posteriorly with resulting injury to the central gray matter. The clinical presentation is variable but usually consists of:

- Greater loss of motor neurons to the upper extremities than the lower extremities often resulting in profound weakness in the arms and hands, and some weakness in the legs and feet
- Variable sensory loss

Patients with central cord syndrome have variable return of function but are usually left with some degree of residual deficit and spasticity.

Correct Answer: A hyperextension injury with compression of the cord by osteophytes anteriorly and infolded ligamentum flavum posteriorly

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2657. (2933) Q6-3436:

Patients with anterior cord syndrome usually presents with:

1) Preservation of motor function, preservation of pain and temperature sensation, and loss of vibration and touch sensation
3) Motor paralysis, loss of pain, temperature, vibration, and touch sensation
2) Preservation of motor function, with loss of pain, temperature, vibration, and touch sensation
5) Motor paralysis, loss of vibration and touch sensation, and preservation of pain and temperature sensation
4) Motor paralysis, loss of pain and temperature sensation, and preservation of vibration and touch sensation

Anterior cord syndrome is due to injury of the anterior elements of the spinal cord, which is usually due to a space-occupying lesion anterior to the cord such as vertebral body fracture fragments, a herniated disk, or a hematoma. The clinical presentation consists of:

- Complete motor paralysis (loss of anterior corticospinal tract)
- Loss of pain/temperature sensation (loss of lateral and anterior spinothalamic tracts)
- Preservation of vibration sensation/proprioception and light touch sensation (preservation of dorsal columns)

In less severe cases, some motor function is preserved through the lateral corticospinal pathways. Prognosis is generally poor and in patients with absence of sacral sensation (pin prick/temperature) after 24 hours following injury, recovery is seen in 10% of patients.

Correct Answer: Motor paralysis, loss of pain and temperature sensation, and preservation of vibration and touch sensation

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2658. (2934) Q6-3437:

A patient with cauda equina syndrome and the full spectrum of symptons presents with:

1) Severe low back pain, sciatica, saddle anesthesia, and preservation of bladder vesicular control
3) Severe low back pain, saddle anesthesia, loss of motor and sensation in the lower extremities, and preservation of bulbocavernosus reflex.
2) Severe low back pain, sciatica, urinary retention, and preservation of perianal sensation
5) Severe low back pain, sciatica, saddle anesthesia, urinary retention, and loss of bulbocavernosus reflex
4) Severe low back pain, loss of motor and sensation in the lower extremities, and preservation of bladder vesicular control

Cauda equina syndrome is a severe neurologic disorder that results from an injury to the neural elements within the thecal sac between the conus medullaris and the lumbosacral nerve roots (ie, cauda equina or "horse's tail"). Cauda equina syndrome usually occurs as a result of lumbar disk herniation with compression of the cauda equina and requires urgent surgical decompression. Clinical presentation includes:

- Severe low back pain
- Bilateral or unilateral sciatica
- Saddle anesthesia
- Motor or sensory deficit
- Bladder and bowel vesicular involvement (classically leading to urinary retention)
- With a complete lesion, a loss of bulbocavernosus reflex, anal wink, and reflexes in the lower extremities

Correct Answer: Severe low back pain, sciatica, saddle anesthesia, urinary retention, and loss of bulbocavernosus reflex

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2659. (2951) Q6-3454:

Which of the following descriptions applies to the sacroiliac joint:

1) The sacroiliac joint accounts for 15% of lower back pain.
3) Focal pain over the sacral sulcus is rare.
2) Pain is referred most commonly to the groin.
5) Provocative tests (Patrick and Gaenslens) are useful predictors of joint pathology.
4) Focal neurological deficits are common.

Sacroiliac joint pathology accounts for 15% of lower back pain, and the sacroiliac joint is one of the most common sites of referred pain. Patients with sacroiliac joint pathology commonly experience pain above the posterior buttock and seldom have focal neurological deficits. Physical examination tests are poor predictors of sacroiliac joint pathology.Correct Answer: The sacroiliac joint accounts for 15% of lower back pain.

2660. (2952) Q6-3455:

Which of the following statements is true regarding the sacroiliac joint:

1) The anterior supporting structures are stronger than the posterior supporting structures.
3) The sacroiliac joint withstands medially directed forces better than the lumbosacral spine.
2) Sectioning of the sacrotuberous and sacrospinous ligaments results in increased motion.
5) The posterior interosseous ligaments are weak.
4) Counter-nutation (forward rotation of the ilium on the sacrum) is the most common motion.

The sacroiliac joint is the largest axial joint in the body. The anterior capsule is thin and weaker than the posterior capsule. The posterior supporting structures are strong and are comprised of a tough interosseous ligament, a long posterior sacroiliac ligament, and strong sacrotuberous, sacrospinous ligaments. Joint innervation usually occurs anteriorly in the S2 ventral rami. Compared with the lumbosacral spine, the sacroiliac joint can better withstand medial forces, but is weaker in axial compression and in axial torsion. Nutation (backward rotation of less than 4Â° and 1.6 mm rotation of the ilium on the sacrum) is the most common motion in the sacroiliac joint. Increased motion of the sacroiliac joint occurs only with sectioning of the interosseous ligaments.Correct Answer: The sacroiliac joint withstands medially directed forces better than the lumbosacral spine.

2661. (2966) Q6-3472:

Osteochondromatosis is a hereditary genetic disorder that is:

1) Autosomal recessive with incomplete penetrance
3) Autosomal dominant with incomplete penetrance
2) Autosomal recessive with complete penetrance
5) Sex-linked recessive
4) Sex-linked dominant

Osteochondromatosis (also known as hereditary multiple exostoses) is a genetic disorder that is autosomal dominant with incomplete penetrance in women. The genetic defect occurs on the EXT1, EXT2, and EXT 3 genes located on chromosome 8q24.Correct Answer: Autosomal dominant with incomplete penetrance

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2662. (2967) Q6-3473:

Osteochondromatosis is a hereditary genetic disorder that is caused by:

1) Mutation in the fibrillin-1 gene
3) Mutation in the g-fos gene
2) Translocation between chromosomes 9 and 22
5) Mutation in the EXT1, EXT2, and/or EXT3 genes
4) Translocation between chromosomes 11 and 22

Osteochondromatosis (also known as hereditary multiple exostoses) is a genetic disorder that is autosomal dominant with incomplete penetrance in women. The genetic defect occurs on the EXT1, EXT2, and EXT 3 genes located on chromosome 8q24. Mutation in the fibrillin-1 gene is seen in patients with Marfan syndrome. Translocation between chromosomes 9 and 22 is seen in myxoid chondrosarcoma. Mutation in the g-fos gene is seen in patients with Ollierâs disease. Translocation between chromosomes 11 and 22 is present in patientâs with Ewingâs tumor.Correct Answer: Mutation in the EXT1, EXT2, and/or EXT3 genes

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2663. (2968) Q6-3474:

Osteochondromas in the spine most commonly occur in:

1) Posterior elements of the cervical spine
3) Posterior elements of the lumbar spine
2) Posterior elements of the thoracic spine
5) Vertebral body of the thoracic spine
4) Posterior elements of the sacral spine

Osteochondromas most commonly occur in the appendicular skeleton but can also occur in the spine (<5% of cases). When present in the spine, solitary osteochondromas have a predilection for the cervical spine. They can, however, also occur in the thoracic and lumbar spine. Sacral involvement is rare.Correct Answer: Posterior elements of the cervical spine

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2664. (2969) Q6-3475:

When an osteoid osteoma occurs in the spine, it can involve all of the following except:

1) Facets
3) Pedicles
2) Transverse processes
5) Vertebral body
4) Rib heads adjacent to thoracic vertebrae

When an osteoid osteoma occurs in the spine, involvement of the posterior elements of the vertebra is typical and includes:

- Lamina
- Pedicles
- Transverse processes
- Facets
- Rib heads adjacent to thoracic vertebrae

Correct Answer: Vertebral body

2665. (2970) Q6-3476:

Typical histologic features of an osteoid osteoma include all of the following except:

1) Chondrocytes in an arrangement similar to that of a physis
3) Varying degrees of mineralization with greatest mineralization in the center of the lesion
2) Nidus composed of haphazardly arranged network of osteoid trabeculae
5) Vascularized spindle cell stroma
4) Osteoblasts rimming the trabeculae

The histologic features of an osteoid osteoma include the following:

- Nidus composed of haphazardly arranged network of osteoid trabeculae
- Varying degrees of mineralization with greatest mineralization in the center of the lesion
- Loose fibrovascular connective tissue between trabeculae
    - Osteoblasts rimming the trabeculae
    - Vascularized spindle cell stroma

Correct Answer: Chondrocytes in an arrangement similar to that of a physis

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2666. (2971) Q6-3477:

Treatment of a vertebral osteoid osteoma includes all of the following except:

1) Surgical excision/curettage of the nidus
3) Observation if symptoms are mild
2) En-bloc resection
5) Radiofrequency ablation
4) Aspirin/salicylates/nonsteroidal anti-inflammatory drugs (NSAIDs)

Treatment of osteoid osteomas in the spine include the following:

- Aspirin/salicylates/NSAIDs
    - Administered for up to 2 years
    - Successful in up to 50% cases
- Radiofrequency ablation (RFA)
    - Usually computed tomography-guided
    - Clinical success rates as high as 97% have been reported with 1 to 2 treatments
- Surgical excision of the nidus/curettage
    - Necessary when aspirin/salicylates/NSAIDs cannot be tolerated for long periods of time and RFA is not possible or unsuccessful
    - Can usually be accomplished through a posterior approach
- En-bloc resection or a more radical procedure play no role in management

Correct Answer: En-bloc resection

2667. (2972) Q6-3478:

Typical symptoms of a spinal osteoblastoma include all of the following except:

1) Torticollis
3) Stiffness
2) Painful scoliosis
5) Radicular symptoms
4) Diskogenic pain

The most common symptoms of spinal osteoblastomas include:

- Pain
  - Usually the first and most common presenting symptom
  - Night pain is not as common as it is with osteoid osteomas
- Night pain is not as common as it is with osteoid osteomas
- Painful scoliosis
- Torticollis
- Stiffness
- Radicular symptoms usually due to mass effect

Correct Answer: Diskogenic pain

2668. (2973) Q6-3479:

When an osteoblastoma occurs in the spine, it can involve all of the following except:

1) Facets
3) Pedicles
2) Transverse processes
5) Vertebral body
4) Lamina

When an osteoblastoma occurs in the spine, involvement of the posterior elements of the vertebra is typical and includes:

- Lamina
- Pedicles
- Transverse processes
- Facets
- Rib heads adjacent to thoracic vertebrae

Correct Answer: Vertebral body

2669. (2974) Q6-3480:

The proper treatment of a vertebral osteoblastoma includes:

1) Chemotherapy
3) Marginal excision/curettage of the tumor
2) En-bloc resection
5) Radiofrequency ablation
4) Radiation

Treatment of spinal osteoblastomas usually consists of marginal excision or curettage of the tumor. Local recurrence rates of up to 10% have been observed from some osteoblastomas, however, malignant degeneration is rare. There is no role for radiation or chemotherapy. Radiofrequency ablation has been used successfully for the treatment of osteoid osteomas, but not osteoblastomas.Correct Answer: Marginal excision/curettage of the tumor

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2670. (2975) Q6-3481:

Typical histologic features of an osteoblastoma include all of the following except:

1) Vascularized spindle cell stroma
3) Occasional areas of aneurysmal bone cyst formation
2) Nidus composed of haphazardly arranged network of osteoid trabeculae
5) Chondrocytes arranged in a zonal pattern
4) Osteoblasts rimming the trabeculae

Histologically osteoblastoma is similar to an osteoid osteoma; its features include:

- Irregular osteoid arranged haphazardly with rimming by round osteoblasts
- Loose fibrovascular connective tissue between trabeculae
    - Osteoblasts rimming the trabeculae
    - Vascularized spindle cell stroma
- Areas of aneurysmal bone cyst formation can be seen

Correct Answer: Chondrocytes arranged in a zonal pattern

2671. (2976) Q6-3482:

What percentage of osteoblastomas occur in the spine:

1) 20% to 30%
3) 40% to 50%
2) 30% to 40%
5) 60% to 70%
4) 50% to 60%

Osteoblastomas are:

- Osteoblastic bone-forming lesions measuring more than 2 cm in size characterized by marked growth potential
- Similar in histology and presentation to osteoid osteoma with the main difference being the size of the tumor
- Most common in the 2nd and 3rd decades of life
- Twice as common in men than in women
- Common in the spine:
    - Spinal osteoblastomas account for 40% to 45% of all osteoblastomas
    - Over half of spinal osteoblastomas occur in the lumbar spine

Correct Answer: 40% to 50%

2672. (2979) Q6-3485:

Primary spinal tumors account for:

1) 0.4% of all tumors and 1% of all bone tumors
3) 0.4 % of all tumors and 25% of all bone tumors
2) 0.4 % of all tumors and 10% of all bone tumors
5) 0.04 % of all tumors and 25% of all bone tumors
4) 0.04% of all tumors and 10% of all bone tumors

Neoplasms of the spine can be broadly categorized into metastatic tumors and primary tumors. Primary spinal tumors are rare and account for 0.04% of all tumors and 10% of all bone tumors.Correct Answer: 0.04% of all tumors and 10% of all bone tumors

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2673. (2980) Q6-3486:

Pain is the most common complaint in patients presenting with a primary spine tumor and is present in which percentage of patients:

1) 55%
3) 75%
2) 65%
5) 95%
4) 85%

I. Pain is the most common complaint in patients presenting with a primary spine tumor
    A. Present in up to 85% of patients
    B. Typically localized to the site of lesion but can be radicular
    C. Characterized as:
        1. Progressive
        2. Gradual in onset
        3. Worse at night
        4. Non-mechanical
    D. Loosely associated with trauma
II. Weakness can be seen in up to 42% of patients
III. Mass is evident in up to 16% of patients
IV. Three percent of patients are asymptomatic
V. Other symptoms can include:
    A. Sensory loss
    B. Loss of sphincter control

Correct Answer: 85%

2674. (2981) Q6-3487:

Patients presenting with a primary spine tumor most often characterize their pain as:

1) Constant, sudden in onset, worse at night, mechanical, and loosely associated with trauma
3) Progressive, gradual in onset, worse at night, non-mechanical, and loosely associated with trauma
2) Constant, gradual in onset, worse at night, non-mechanical, and loosely associated with trauma
5) Progressive, gradual in onset, worse at night, mechanical, and loosely associated with trauma
4) Progressive, sudden in onset, worse at night, mechanical, and loosely associated with trauma

I. Pain is the most common complaint in patients presenting with a primary spine tumor
    A. Present in up to 85% of patients
    B. Typically localized to the site of lesion but can be radicular
    C. Characterized as:
        1. Progressive
        2. Gradual in onset
        3. Worse at night
        4. Non-mechanical
            a. Loosely associated with trauma
    D. Weakness can be seen in up to 42% of patients
    E. Mass is evident in up to 16% of patients
    F. Three percent of patients are asymptomatic
    G. Other symptoms can include:
        1. Sensory loss
        2. Loss of sphincter control

Correct Answer: Progressive, gradual in onset, worse at night, non-mechanical, and loosely associated with trauma

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2675. (2982) Q6-3488:

What percentage of trabecular bone must be destroyed before changes can be seen on plain radiographs:

1) 20% to 40%
3) 40% to 60%
2) 30% to 50%
5) 70% to 90%
4) 60% to 80%

I. Imaging studies used most frequently in the diagnosis of primary spine tumors include:
   A. Plain radiographs
      1. Initial imaging study
      2. Recommended for any patient with prolonged back pain (>6 weeks)
      3. Identify 30% to 70% of spine tumors at presentation
      4. Early lesions difficult to detect because 30% to 50% of trabecular bone must be destroyed before changes can be seen
      5. Absence of the pedicle is usually the earliest radiographic sign of vertebral
      6. Cortical bone loss easier to detect than destruction of trabecular bone
      7. "Winking owl" sign
      8. Disk space generally preserved
      9. Geographic lesions with well-circumscribed borders suggest a benign tumor
      10. Permeative lesions suggest a malignant tumor
   B. Bone scan
      1. Technetium (Tc)-99m
      2. Can identify lesions 3 to 18 months before plain radiographs
      3. Sensitivity 74%, specificity 81%
      4. False negative in up to 60% of patients with multiple myeloma
      5. Single photon emission computerized tomography scan can improve both sensitivity (87%) and specificity (91%)
      6. When used in combination with gallium scanning, Tc-99 bone scan can help to differentiate between tumors and infections
   C. Computed tomography/myelography
      1. Best test to determine extent of bony destruction
      2. Important in surgical planning
      3. Myelography usually used only when magnetic resonance imaging (MRI) not possible (danger of complete myelographic block)
   D. MRI
      1. Modality of choice in evaluating tumors of the spine
      2. Noninvasive
      3. Allows direct visualization of entire spinal cord
      4. Visualization of soft tissues
      5. Sensitivity 92%, specificity 90%
      6. Additional lesions in 20% to 24%, and 10% will have multiple levels of cord compression

Correct Answer: 30% to 50%

2676. (2983) Q6-3489:

Which of the following is considered to be a malignant primary spine tumor:

1) Osteoblastoma
3) Giant cell tumor
2) Eosinophilic granuloma
5) Aneurysmal bone cyst
4) Chordoma

I. Primary benign tumors of the spine are:
    A. Slow-growing
    B. Well-circumscribed
    C. Usually occur in patients younger than 21 years of age
    D. Involve the vertebral body and posterior elements of the spine
        1. Overall slight predilection for the posterior elements
        2. Location of tumor is an important factor in determining the type of tumor
    E. Examples include:
        1. Osteochondroma
        2. Osteoid osteoma
        3. Osteoblastoma
        4. Aneurysmal bone cyst
        5. Giant cell tumor
        6. Eosinophilic granuloma

II. Primary malignant tumors of the spine are:
    A. Fast-growing
    B. Permeative
    C. Usually occur in patients older than 21 years of age
    D. Examples include:
        1. Multiple myeloma/solitary plasmacytoma
        2. Osteosarcoma
        3. Chondrosarcoma
        4. Ewing's sarcoma/primitive neuroectodermal tumor
        5. Chordoma
        6. Lymphoma

Correct Answer: Chordoma

2677. (2984) Q6-3490:

Which of the following tumors is considered to be a benign primary spine tumor:

1) Osteosarcoma
3) Multiple myeloma
2) Chordoma
5) Lymphoma
4) Osteoblastoma

I. Primary benign tumors of the spine are:
    A. Slow-growing
    B. Well-circumscribed
    C. Usually occur in patients younger than 21 years of age
    D. Involve the vertebral body and posterior elements of the spine
        1. Overall slight predilection for the posterior elements
        2. Location of tumor is an important factor in determining the type of tumor
    E. Examples include:
        1. Osteochondroma
        2. Osteoid osteoma
        3. Osteoblastoma
        4. Aneurysmal bone cyst
        5. Giant cell tumor
        6. Eosinophilic granuloma

II. Primary malignant tumors of the spine are:
    A. Fast-growing
    B. Permeative
    C. Usually occur in patients older than 21 years of age
    D. Examples include:
        1. Multiple myeloma/solitary plasmacytoma
        2. Osteosarcoma
        3. Chondrosarcoma
        4. Ewing's sarcoma/primitive neuroectodermal tumor
        5. Chordoma
        6. Lymphoma

Correct Answer: Osteoblastoma

2678. (2985) Q6-3491:

Primary malignant tumors of the spine have which of the following characteristics:

1) Slow-growing, well-circumscribed, and usually occur in patients older than 21 years of age
3) Fast-growing, permeative, and usually occur in patients older than 21 years of age
2) Slow-growing, well-circumscribed, and usually occur in patients younger than 21 years of age
5) Fast-growing, permeative, and usually occur in patients older than 40 years of age
4) Fast-growing, permeative, and usually occur in patients younger than 21 years of age

I. Primary benign tumors of the spine are:
    A. Slow-growing
    B. Well-circumscribed
    C. Usually occur in patients younger than 21 years of age
    D. Involve the vertebral body and posterior elements of the spine
        1. Overall slight predilection for the posterior elements
        2. Location of tumor is an important factor in determining the type of tumor
    E. Examples include:
        1. Osteochondroma
        2. Osteoid osteoma
        3. Osteoblastoma
        4. Aneurysmal bone cyst
        5. Giant cell tumor
        6. Eosinophilic granuloma

II. Primary malignant tumors of the spine are:
    A. Fast-growing
    B. Permeative
    C. Usually occur in patients older than 21 years of age
    D. Examples include:
        1. Multiple myeloma/solitary plasmacytoma
        2. Osteosarcoma
        3. Chondrosarcoma
        4. Ewing's sarcoma/primitive neuroectodermal tumor
        5. Chordoma
        6. Lymphoma

Correct Answer: Fast-growing, permeative, and usually occur in patients older than 21 years of age

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2679. (3069) Q6-3577:

All of the following are elements of the lateral mass of cervical spinal segments except:

1) Inferior articulating process
3) Spinous process
2) Superior articulating process
5) Transverse foramen
4) Transverse process

The lateral mass of the cervical spinal segments includes the inferior and superior articulating processes, the transverse foramen, and the transverse process. The spinous process is not an element of the lateral mass.Correct Answer: Spinous process

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2680. (3070) Q6-3578:

Advantages of minimally invasive lumbar interbody fusion over traditional open interbody fusion include:

1) Minimal muscle dissection and trauma
3) Better fusion rates
2) Wider surgical exposure
4) Lowered risk of nerve root injury

Minimally invasive lumbar interbody fusion involves less muscle dissection and trauma than traditional open approaches. The surgical exposure is more limited, though, and there is no evidence to date of minimally invasive techniques providing better fusion rates or lowered risk of nerve root injury.Correct Answer: Minimal muscle dissection and trauma

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2681. (3111) Q6-3621:

Which of the following statements is true regarding minimally invasive posterior lumbar interbody fusion:

1) Minimally invasive fusion may only be safely performed with the assistance of endoscopy.
3) Internal fixation with pedicle screws is not possible via the minimally invasive approach.
2) Minimally invasive fusion has increased risk of nerve root injury.
4) Intraoperative fluoroscopy if of great value in minimally invasive fusion.

Intraoperative fluoroscopy or radiography is vital for the proper identification of lumbar level and vertebral structures in minimally invasive posterior lumbar interbody fusions. While endoscopic assistance has been well described as a method of minimally invasive fusion, it is not vital to this technique. There is no evidence of increased risk of nerve root injury with minimally invasive techniques, and it is possible to internally fixate the lumbar segment with pedicle screws through minimally invasive techniques.Correct Answer: Intraoperative fluoroscopy if of great value in minimally invasive fusion.

2682. (3137) Q6-3855:

A 21-year-old man presented to the emergency department after sustaining a low-velocity gunshot wound to his midback resulting in grade 0 (out of 5) weakness in his quadriceps and tibialis anterior muscles. His extensor hallucis longus and gastrocnemius/soleus muscles were grade 3 (out of 5) bilaterally. His sensation remained intact. An intradural bullet fragment was seen at T12. No fracture was seen on computed tomography (CT) scan. Management should consist of:

1) Administration of methylprednisolone 30 mg/kg bolus followed by an infusion of 5.4 mg/kg for 24 hours.
3) Administration of broad-spectrum antibiotics for 14 days.
2) Application of a thoracolumbosacral orthosis (TLSO).
5) Removal of the bullet fragment and instrumented fusion from T10 to L2.
4) Removal of the bullet fragment.

In complete and incomplete lesions from T12 to L4, removal of the bullet fragment from the canal has been associated with significant motor recovery. This improvement is not seen in other regions of the spine.

High-dose steroids have not been shown to offer improvement in patients with spinal cord injury after a gunshot wound, and the complications of high-dose steroids have been documented in this population. The majority of gunshot wounds to the spine are stable injuries. This patientâs CT scan does not demonstrate any instability. Therefore, neither nonoperative (eg, TLSO bracing) nor operative (instrumented fusion) stabilization is indicated. While infection after transalimentary bullet wounds to the spine is a well-documented complication, this patientâs injury was sustained from the back, thereby avoiding the alimentary canal and obviating the need for intravenous antibiotics.

Correct Answer: Removal of the bullet fragment.

2683. (3155) Q6-3974:

In relation to the lumbar pedicle, the exiting nerve root is found:

1) Immediately superior to the pedicle
3) At the midpoint between the superior and inferior level pedicles
2) Immediately inferior to the pedicle
5) None of the above
4) Nerve root has no anatomic relationship to the pedicle

The exiting nerve root is found traversing immediately inferior to the pedicle.Correct Answer: Immediately inferior to the pedicle

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2684. (3156) Q6-3975:

Regarding the anatomy of the lumbar pedicle, which of the following statements is true:

1) The pedicle is located at the origin of the transverse process.
3) The pedicle is located at the base of the superior facet, at the origin of the transverse process.
2) The exiting nerve root is found immediately superior to the lumbar pedicle.
5) There is no relationship between the pedicle and the superior facet.
4) The pedicle joins the vertebral body at its inferior border.

The lumbar pedicle is the bony bridge that connects the posterior vertebral elements to the anterior body. The pedicle is located at the base of the superior facet, at the origin of the transverse process. The exiting nerve root traverses immediately inferior to the superior segment pedicle, and the pedicle joins the vertebral body at its superior half.Correct Answer: The pedicle is located at the base of the superior facet, at the origin of the transverse process.

2685. (3157) Q6-3976:

Which of the following serves as the best landmark for proper screw entry into the lumbar pedicle:

1) The junction of the transverse process and inferior facet
3) The articulating interface of the superior and inferior facets
2) The junction of the transverse process and superior facet
5) There is no relationship between the nerve root and the superior facet.
4) The medial border of the superior facet

The junction of the transverse process and the inferior facet represents the most appropriate entry point of the pedicle screw. This junction directly overlies the pedicle and ensures safe placement through the pedicle and into the vertebral body.Correct Answer: The junction of the transverse process and inferior facet

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2686. (3158) Q6-3977:

A potential major complication of lumbar pedicle screws is:

1) Lateral screw breakout injuring the vertebral artery
3) Medial screw breakout injuring the vertebral artery
2) Lateral screw breakout injuring the exiting nerve root
5) Medial screw breakout causing vertebral fracture
4) Medial screw breakout injuring the exiting nerve root

The exiting nerve root traverses immediately medial then caudal to the lumbar pedicle. Therefore, a screw that breaks out medially or inferiorly from the pedicle is a potential risk to the nerve root.Correct Answer: Medial screw breakout injuring the exiting nerve root

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2687. (3159) Q6-3978:

Common indications for lumbar pedicle screw fixation include:

1) Rigid stabilization for patients undergoing arthrodesis or interbody fusion
3) Stabilization after trauma to the lumbar spine
2) Correction of lumbar spinal deformity
5) Rigid stabilization for patients undergoing arthrodesis or interbody fusion, correction of lumbar spinal deformity and stabilization after trauma to the lumbar spine
4) Rigid stabilization for patients undergoing arthrodesis or interbody fusion, and correction of lumbar spinal deformity

Common indications for pedicle screw fixation include rigid stabilization for patients undergoing arthrodesis or interbody fusion, correction of deformity, and stabilization after trauma.Correct Answer: Rigid stabilization for patients undergoing arthrodesis or interbody fusion, correction of lumbar spinal deformity and stabilization after trauma to the lumbar spine

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2688. (3160) Q6-3979:

Advantages of minimally invasive lumbar interbody fusion over traditional open interbody fusion include:

1) Minimal muscle dissection and trauma
3) Better fusion rates
2) Wider surgical exposure
5) Better decompression
4) Lowered risk of nerve root injury

Minimally invasive lumbar interbody fusion involves less muscle dissection and trauma than traditional open approaches. The surgical exposure is more limited, though, and there is no evidence to date of minimally invasive techniques providing better fusion rates or lowered risk of nerve root injury.Correct Answer: Minimal muscle dissection and trauma

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2689. (3161) Q6-3980:

Which of the following instruments are of value to a surgeon when performing minimally invasive lumbar fusions:

1) Surgical loupes and headlight
3) Intraoperative fluoroscopy
2) Operating microscope
5) Surgical loupes and headlight, operating microscope, and intraoperative fluoroscopy
4) Surgical loupes and headlight and operating microscope

All of the above instruments are of value to a surgeon when performing minimally invasive lumbar fusion.Correct Answer: Surgical loupes and headlight, operating microscope, and intraoperative fluoroscopy

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2690. (3162) Q6-3981:

Which of the following statements is true regarding minimally invasive posterior lumbar interbody fusion:

1) Minimally invasive fusion may be safely performed only with the assistance of endoscopy.
3) Internal fixation with pedicle screws is not possible via the minimally invasive approach.
2) Minimally invasive fusion increases the risk of nerve root injury.
5) Minimally invasive surgery has improved fusion rates.
4) Intraoperative fluoroscopy is of great value in minimally invasive fusion.

Intraoperative fluoroscopy or radiography is vital for the proper identification of lumbar level and vertebral structures in minimally invasive posterior lumbar interbody fusions. While endoscopic assistance has been well described as a method of minimally invasive fusion, it is not vital to this technique. There is no evidence to date of increased risk of nerve root injury with minimally invasive techniques, and it is possible to internally fixate the lumbar segment with pedicle screws through minimally invasive techniques.Correct Answer: Intraoperative fluoroscopy is of great value in minimally invasive fusion.

2691. (3163) Q6-3982:

Which of the following is not a described technique of minimally invasive anterior lumbar interbody fusion:

1) Laparoscopic transperitoneal
3) Mini-open retroperitoneal
2) Endoscopic retroperitoneal
5) None of the above are described techniques
4) All of the above are described techniques

All of the above are well-described techniques of minimally invasive anterior lumbar interbody fusion.Correct Answer: All of the above are described techniques

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2692. (3164) Q6-3983:

Which of the following statements is false regarding minimally invasive transperitoneal anterior lumbar interbody fusion:

1) This technique may be safely performed at all lumbar levels.
3) Laparoscopy is of great value in the transperitoneal approach to the anterior lumbar spine.
2) This technique allows direct access to pathology in the vertebral body.
5) None of the above
4) There is a potential risk of injuring the aorta and its bifurcation with this technique.

Due to the potential risk of injury to the aorta and its bifurcation, which occurs at the L4 level, this procedure is difficult and may be impossible to perform above the L4 level. Retroperitoneal approaches allow access to more superior lumbar levels due to the more lateral trajectory taken to avoid the aorta and its bifurcation.Correct Answer: This technique may be safely performed at all lumbar levels.

2693. (3165) Q6-3984:

All of the following are elements of the lateral mass of cervical spinal segments except:

1) Inferior articulating process
3) Spinous process
2) Superior articulating process
5) Transverse foramen
4) Transverse process

The lateral mass of the cervical spinal segments includes the inferior and superior articulating processes, the transverse foramen, and the transverse process. The spinous process is not an element of the lateral mass.Correct Answer: Spinous process

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2694. (3166) Q6-3985:

To avoid vertebral artery injury during cervical lateral mass screw placement, it is best to:

1) Start at the midpoint and aim the screw laterally
3) Start medially and aim the screw perpendicular
2) Start at the midpoint and aim the screw medially
5) Start laterally and aim the screw medially.
4) Start medially and aim the screw medially

To avoid injury to the vertebral artery when placing lateral mass screws, it is best to avoid placing the screw in the medial portion of the lateral mass, where the vertebral body is most likely to be found.Correct Answer: Start at the midpoint and aim the screw laterally

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2695. (3167) Q6-3986:

Which of the following is/are potential complications associated with posterior cervical decompression and placement of lateral mass screws:

1) Injury to the vertebral artery
3) Traction injury to the cervical nerve roots
2) Compression injury to the spinal cord
5) Injury to the vertebral artery, traction injury to the cervical nerve, and traction injury to the cervical nerve roots
4) Injury to the vertebral artery and traction injury to the cervical nerve roots only

All of the above are potential complications associated with posterior cervical decompression and placement of lateral mass screws.Correct Answer: Injury to the vertebral artery, traction injury to the cervical nerve, and traction injury to the cervical nerve roots

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2696. (3168) Q6-3987:

Which of the following statements is true regarding the C2 lateral mass:

1) The vertebral artery assumes a more lateral position at this level.
3) The vertebral artery is found outside of the transverse foramen at this level.
2) The vertebral artery assumes a more medial position at this level.
5) None of the above
4) The vertebral artery precludes placement of lateral mass screws at this level.

The vertebral artery assumes a more lateral position at the C2 level; therefore, screw placement at this level should follow a medial trajectory to avoid injury to the vertebral artery.Correct Answer: The vertebral artery assumes a more lateral position at this level.

2697. (3169) Q6-3988:

The technique for C1-C2 lateral mass fixation may involve:

1) Removal of the posterior arch of C1
3) Following a medial trajectory with the C1 screws
2) Placing the C2 screws through the pedicle
5) Removal of the posterior arch of C1, placing the C2 screws through the pedicle, and following a medial trajectory with the C1 screws
4) Removal of the posterior arch of C1, and placing the C2 screws through the pedicle only

The C1 and C2 levels have unique anatomies that require variation in lateral mass screw fixation technique. Removing the C1 arch assists in proper placement of the C1 screws via a lateral trajectory. The C2 pedicle is large, and pedicle screws are commonly placed at this level to avoid vertebral artery injury in the small lateral masses. C1 lateral mass screws follow the long axis of the C1 lateral mass as visualized on pre-operative CT scanning.Correct Answer: Removal of the posterior arch of C1, and placing the C2 screws through the pedicle only

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2698. (3170) Q6-3989:

Which of the following conditions is not associated with cervical fractures:

1) Rheumatoid arthritis
3) Ankylosing spondylitis
2) Ossiculum terminale
5) None of the above
4) Os odontoideum

Rheumatoid arthritis, ankylosing spondylitis, and os odontoideum have been associated with fractures as part of their presentation or etiology. Os odontoideum is most likely an old nonunion fracture or injury to vascular supply of the developing odontoid process. However, one has to differentiate true os odontoideum from the more common ossiculum terminale, which describes the nonunion of the apex at the secondary ossification center and is not a fracture.Correct Answer: Ossiculum terminale

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2699. (3171) Q6-3990:

Which of the following pathogens is not typically implicated in diskitis:

1) *Staphylococcus aureus*
3) *Pseudomonas aeruginosa*
2) *Staphylococcus albus*
5) Gram-positive cocci
4) *Staphylococcus epidermidis*

The gram-positive cocci are typical opportunistic pathogens that are capable of causing infection in the vertebral disk space. Most commonly they seed via the hematogenous route but local translocation has also been implicated. Unless a patient has been hospitalized for a while and iatrogenesis is ruled out, Pseudomonas species usually do not cause diskitis.Correct Answer: *Pseudomonas aeruginosa*

2700. (3172) Q6-3991:

Which imaging modality is usually the least sensitive in diagnosing discitis:

1) Plain radiograph
3) Magnetic resonance image (MRI)
2) Computed tomography (CT) scan
5) Tomograms
4) Technetium bone scan

The least helpful modality in diagnosing early discitis is the plain radiograph. Fluoroscopy does not give insight into the state of the intervertebral disk. It can suggest loss of disk height or involvement of the vertebral bone but will not reveal infection limited to the disk. The CT scan is useful because of its excellent resolution of bony structures and associated changes secondary to disk infection. MRI is the best modality to characterize the soft tissues in the cervical spine.Correct Answer: Plain radiograph

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2701. (3173) Q6-3992:

Pottâs disease is most commonly treated by:

1) Decompression
3) Antibiotic therapy only
2) Antibiotic therapy and immobilization
5) Decompression and fusion
4) Spinal orthosis

The treatment of tuberculous involvement of the spine is rarely surgical. Most commonly, the spine remains stable and fusion is not necessary. However, orthosis in combination with long-term antibiotic therapy is the key for successful treatment. A collar is sufficient to provide enough stability and comfort for the lesion to heal.Correct Answer: Antibiotic therapy and immobilization

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2702. (3174) Q6-3993:

Which of the following is characteristic of patients with Klippel-Feil syndrome:

1) Absence of the vertebral pedicles
3) Shortened pedicles
2) Absence of intervertebral joints
5) Increased interpediculate distance
4) A narrow spinal canal

Klippel-Feil syndrome is a rare disorder characterized by the congenital fusion of any two of the seven cervical vertebrae. The cause is a failure in the early segmentation during fetal development. The fused segments show absence of intervertebral joints. Associated abnormalities may include scoliosis; spina bifida; anomalies of the kidneys and ribs; and other midline anomalies.Correct Answer: Absence of intervertebral joints

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2703. (3186) Q6-4005:

A burst fracture results in failure of the:

1) Anterior column
3) Posterior column
2) Middle column
5) Middle and posterior columns
4) Anterior and middle columns

A burst fracture by definition is failure of the anterior and middle columns due to axial loading, which often leads to instability and neurologic impairment.Correct Answer: Anterior and middle columns

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2704. (3187) Q6-4006:

Slide 1

What type of fracture is presented in the radiograph (Slide):

1) Teardrop fracture
3) Compression fracture
2) Burst fracture
5) Clay-shovelerâs fracture
4) Hangmanâs fracture

Clearly seen in this radiograph is a fracture along the anterior/inferior vertebral body, which is a characteristic of a teardrop fracture.Correct Answer: Teardrop fracture

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2705. (3188) Q6-4007:

Slide 1

What type of fracture is presented in the radiograph (Slide):

1) Teardrop fracture
3) Compression fracture
2) Burst fracture
5) Clay-shovelerâs fracture
4) Hangmanâs fracture

Clearly seen in this radiograph is a fracture along the anterior/inferior vertebral body, which is a characteristic of a teardrop fracture.Correct Answer: Teardrop fracture

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2706. (3189) Q6-4008:

Which of the following may be used as treatment options for bilateral facet dislocations:

1) Traction reduction of dislocations
3) Open reduction
2) Halo fixation
5) All of the above
4) Open fixation

All of the choices are used in the treatment of bilateral jumped facets, often in combination or sequence.Correct Answer: All of the above

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2707. (3190) Q6-4009:

Which of the following fracture types is the most stable fracture:

1) Teardrop fracture
3) Unilateral facet dislocation
2) Burst fracture
5) Clay-shovelerâs fracture
4) Hangmanâs fracture

The avulsion of part or all of the spinous process that occurs after a violent flexion motion is a one-column injury. The injury is a stable fracture treated by external orthosis, which rarely results in neurologic impairment. The other answer choices may be considered stable in some instances, but none of them are stable all of the time.Correct Answer: Clay-shovelerâs fracture

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2708. (3191) Q6-4010:

Unilateral facet dislocation may be distinguished radiographically from bilateral facet dislocation by which of the following features:

1) Misalignment of the spinous processes
3) Subluxation <25%
2) Subluxation >50%
5) Spinal canal compromise
4) Marked angular deformity

Unilateral jumped facets typically involve anterolisthesis of the upper vertebral body, which is less than 25%. Misalignment of the spinous processes and spinal canal compromise may be seen with either unilateral or bilateral facet dislocation. Subluxation greater than 50% and marked angular deformity are characteristics of bilateral facet dislocations.Correct Answer: Subluxation <25%

2709. (3271) Q6-4114:

The annual incidence of cervical radiculopathy in men is 107.3 per 100,000 and 63.5 per 100,000 in women. The incidence for both groups occurs within which of the following peak age ranges:

1) 45-49 years
3) 55-59 years
2) 50-54 years
5) 65-69 years
4) 60-64 years

Although the incidence rate of cervical radiculopathy in men is nearly double the rate found in women, the peak age range is the same (50-54 years).Correct Answer: 50-54 years

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2710. (3272) Q6-4115:

Which of the following structures are found within an intervertebral foramen:

1) Dorsal root ganglion
3) Radicular artery and vein
2) Connective tissue
5) All of the above
4) Recurrent meningeal nerves

In addition to the dorsal root ganglion, connective tissue, radicular artery and vein, and recurrent meningeal nerves, spinal nerve roots and adipose also comprise an intervertebral foramen.Correct Answer: All of the above

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2711. (3273) Q6-4116:

Most cervical radiculopathy occurs as a result of inflammatory mediators released after mechanical injury, without direct compression of the nerve root(s).

1) True
2) False

Approximately 75% of cervical radiculopathies occur as a result of direct compression of nerve roots, with at least one study noting âa pressure of only 10 mm Hg produced significant conduction block, the potential [of nerve impulses] falling under 60 percent of its initial value in 15 minutes. With higher levels of pressure, we have observed incomplete recovery after many hours of recording.â Disk protrusion, with the associative release of inflammatory mediators, is responsible for up to 25% of cervical radiculopathies. One study even suggests âchemical release from the nucleus pulposus into the nerve root epidural space, without herniation of the nucleus pulposus and without direct nerve root compression, caused radiculopathic pain in an animal model.âCorrect Answer: False

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2712. (3274) Q6-4117:

C1 reflexes include which of the following:

1) Sternocleidomastoid reflex
3) Deltoid reflex
2) Clavicle reflex
5) Biceps reflex
4) Jaw jerk

The C1 reflex, while rarely tested, involves the jaw jerk.Correct Answer: Jaw jerk

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2713. (3275) Q6-4118:

Typical C3 reflexes include which of the following:

1) Sternocleidomastoid reflex
3) Pectoralis reflex
2) Head retraction reflex
5) None of the above
4) Biceps reflex

No reflexes are associated with the C3 spinal nerve.Correct Answer: None of the above

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2714. (3276) Q6-4120:

Which of the following is a distinguishing feature of a C7 radiculopathy rarely found in C6 radiculopathies:

1) Paresthesia of the middle finger
3) Little to no pain in associated muscles
2) Anterior chest pain
5) None of the above
4) âEpauletâ pain in the associated shoulder and lateral arm

C7 radiculopathies classically entail pain and/or sensory changes involving the middle finger. C6 radicular symptoms generally involve the thumb and first finger. C8 radiculopathies involve the pinkie and ring fingers.Correct Answer: Paresthesia of the middle finger

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2715. (3277) Q6-4121:

Studies suggest that cervical radiculopathy (or related pathology) of which nerve root may partially explain the phenomenon of cervicogenic headaches:

1) C3
3) C5
2) C4
5) C7
4) C6

Headaches observed with upper cervical pathology may be due, in part, to the convergence of C1-, C2-, and C3-level pain fibers with second-order neurons of the descending sensory tract of cranial nerve V.Correct Answer: C3

2716. (3278) Q6-4122:

Which of the following diagnostic tests is preferred for suspected cervical radiculopathy:

1) Chest radiograph
3) C-reactive protein assay
2) Magnetic resonance imaging
5) All of the above
4) Myelogram

Although myelogram and nerve conduction studies are useful tests, they are invasive. Magnetic resonance imaging studies are the most appropriate choice for diagnosis. Most important in the diagnosis of cervical radiculopathy is a thorough history and physical examination.Correct Answer: Magnetic resonance imaging

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2717. (3279) Q6-4123:

What is the preferred treatment method for patients with cervical radiculopathy:

1) Physical therapy
3) Medical management (eg, nonsteroidal anti-inflammatory drugs, opioids, and corticosteroids)
2) Surgical repair
5) None of the above
4) Bed rest

Most patients with cervical radiculopathy are best treated medically after the age of 50. In other age groups, based on the history, physical examination, and number of involved nerve roots, a combination of the above methods may be appropriate. Surgical therapy may be necessary in patients refractory to medical management.Correct Answer: Medical management (eg, nonsteroidal anti-inflammatory drugs, opioids, and corticosteroids)

2718. (3351) Q6-4231:

A 17-year-old high school football player presents to the emergency department after being removed from play following a harsh tackle. The patient reports a sharp burning and stinging pain through his left arm that has not resolved since the tackle. A careful history revealed that this is the fourth episode of burning and stinging pain. In each episode of pain, the symptoms have lasted longer than the previous episode. The patient also reports that he has suffered from two prior episodes of transient weakness and numbness in all extremities following harsh tackles. Which of the following statements concerning this patient is correct:

1) There is no contraindication to return to play in this patient.
3) There is an absolute contraindication to return to play in this patient.
2) There is a relative contraindication to return to play in this patient.
5) The patient should not participate in football games, but should feel free to continue lifting weights and practicing.
4) Because this patient has suffered repeated episodes of transient pain after tackles, he is obviously experienced enough to not need education and counseling to help prevent recurrence.

It is important to understand the current return to play criteria for cervical spine injuries in athletes. There is an absolute contraindication to return to play in patients who have: a) more than two previous episodes of transient quadriparesis/quadriplegia, b) clinical history, physical examination findings, or imaging confirmation of cervical myelopathy/myelomalacia, and c) continued cervical neck discomfort, decreased range of motion, or any evidence of a neurologic deficit from baseline after any cervical spine injury. Patient education and follow-up are always indicated in patients with burners and stingers. This patient should not participate in football games, exercise, or practice until full mobility and strength has returned, and all neurologic symptoms have resolved.Correct Answer: There is an absolute contraindication to return to play in this patient.

2719. (3352) Q6-4232:

Which of the following statements regarding radiographic evaluation of patients with burners and stingers is correct:

1) A Torg ratio > 0.8 indicates that cervical spinal stenosis may be present.
3) An extension lateral cervical conventional radiograph is used to determine the Torg ratio.
2) A Torg ratio , 0.8 indicates that cervical spinal stenosis may be present.
5) A Torg ratio , 0.8 indicates that cervical spinal stenosis may be present, and an extension lateral cervical conventional radiograph is used to determine the Torg ratio.
4) A Torg ratio > 0.8 indicates that cervical spinal stenosis may be present, and an extension lateral cervical conventional radiograph is used to determine the Torg ratio.

The Torg ratio is calculated using an extension lateral cervical radiograph. To calculate the Torg ratio, divide the distance between the midpoint of the posterior aspect of the vertebral body to the nearest point on the corresponding spinolaminar line by the anteroposterior width of the vertebral body. A Torg ratio , 0.8 is associated with cervical spinal stenosis and sustained burners and stingers in athletes with cervical spine-extension-compression type injuries.Correct Answer: A Torg ratio , 0.8 indicates that cervical spinal stenosis may be present, and an extension lateral cervical conventional radiograph is used to determine the Torg ratio.

2720. (3353) Q6-4233:

Which of the following statements concerning burners and stingers is incorrect:

1) Burners and stingers typically result from depression of the ipsilateral shoulder and deviation of the neck to the contralateral side.
3) In treating burners and stingers, it is important to restore pain-free mobility in the upper extremities by strengthening and stretching.
2) Burners and stingers are commonly seen in elderly patients.
5) None of the above
4) Follow-up and patient education are important in all cases of burners and stingers, regardless of the duration of symptoms.

Burners and stingers are usually seen in children, adolescents, and athletes. Choice A is correct, and explains why burners and stingers are typically seen in tackle injuries sustained by football players and in motorcycle accidents. Choices C and D are correct because management of patients with burners and stingers should always include strengthening, stretching, patient education, and follow-up.Correct Answer: Burners and stingers are commonly seen in elderly patients.

2721. (3354) Q6-4235:

A 26-year-old man with HIV presents to your office with symptoms of lower back pain, difficulty with ambulation, loss of appetite, mild fever, and malaise for 2 weeks. The patient states that he has had difficulty with compliance to his medical management. You suspect that he has a low CD4 count, which is confirmed by laboratory tests. Physical examination reveals tenderness at the L4-L5 level. The patient has abnormal gait. Ankle dorsiflexion and plantarflexion are 1 out of 5 bilaterally. The Achilles tendon reflex is absent bilaterally; all other reflexes are normal. A T2-weighted magnetic resonance imaging (MRI) study shows slightly increased intensity of the disk at the L4-L5 level and an obvious epidural abscess. Conventional radiographs of the lumbar region are normal. Management of this patient should consist of:

1) Admission to the intensive care unit (ICU) and intravenous administration of broad-spectrum antibiotics
3) Counseling the patient on the importance of compliance with medical management
2) Consideration of urgent surgical intervention and evacuation of the epidural abscess
5) All of the above
4) Surveillance for signs of further neurologic deterioration

All of the above answer choices are correct. The patient described above has HIV and is severely immunocompromised. Because of the severity of the patientâs condition, immediate admission to the ICU and intravenous administration of a broad-spectrum antibiotic regimen is indicated. Biopsy and drainage of the infected regions should be performed. It is important in this case to monitor the patient for any signs of neurologic deterioration. Finally, to prevent recurrent cases of diskitis, or other infections, it is important to counsel the patient on compliance with medical management.Correct Answer: All of the above

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2722. (3355) Q6-4236:

Which of the following statements regarding diskitis is correct:

1) Signs and symptoms of diskitis generally progress rapidly.
3) Diskitis commonly occurs in the thoracic region of the spine.
2) Intravenous drug use and immunocompromise are not generally considered risk factors for diskitis.
5) All of the above
4) Blood cultures are generally positive in up to 70% of patients with diskitis.

Diskitis is usually indolent, and patients live with symptoms for several months before seeking treatment. Intravenous drug use and immunocompromise are two important risk factors for diskitis, along with surgical procedures involving the spine. Diskitis rarely occurs in the thoracic spine; instead, diskitis usually occurs in the lumbar spine. Blood cultures should be taken in any patient with suspected diskitis.Correct Answer: Blood cultures are generally positive in up to 70% of patients with diskitis.

2723. (3356) Q6-4237:

Which of the following statements regarding lesions of the spinal cord caused by bullet wounds is true:

1) Twenty-five percent of patients with complete lesions recover one motor level after 1 year.
3) Complete lesions occur in more than 50% of all gunshot wounds to the spine.
2) Thirty-three percent of patients with incomplete lesions usually have a partial or complete recovery after 1 year.
5) All of the above
4) Seventy-five percent of patients in whom the bullet has passed through the spinal canal will experience a complete lesion.

All of the statements are true. Knowledge of these facts is important in decision-making and management of patients who are victims of gunshot wounds to the spine.Correct Answer: All of the above

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2724. (3357) Q6-4238:

An 18-year-old man presents to the emergency department after sustaining a high-velocity gunshot wound to the umbilical region of the abdomen. An exit wound is found at the L3-L5 region of the lower back. Neurological examination shows grade 0/5 strength in his tibialis anterior muscles, gastrocnemius/soleus muscles, and extensor hallucis longus muscles bilaterally. His quadriceps and hamstrings strength is grade 2/5 bilaterally. A bullet fragment was seen at L4 within the spinal canal on computed tomography (CT) imaging. The patient sustained significant gastrointestinal trauma as a result of the bullet traversing his body. Management should consist of:

1) Administration of a broad-spectrum antibiotic for 14 days
3) Continued serial neurologic examinations
2) Removal of the bullet fragment at L4
5) A, B, and C
4) Intravenous administration of dexamethasone for 24 hours

Because the bullet entered the patientâs umbilical region of the abdomen, significant gastrointestinal damage is suspected. When this occurs, administration of a broad-spectrum antibiotic for 7 to 14 days is indicated to prevent infection and sepsis from gastrointestinal flora. The bullet fragment at L4 should be removed because studies have shown that removal of a bullet from a patient with complete or incomplete neural deficits at T12 to L4 is associated with statistically significant increases in motor recovery as compared to nonoperative management. Intravenous administration of dexamethasone is not indicated for gunshot wounds to the spine because the benefits of steroids do not outweigh the risks.Correct Answer: A, B, and C

2725. (3358) Q6-4241:

Magnetic resonance imaging (MRI) is appropriate in which of the following circumstances:

1) Malignancy is suspected as a cause of kyphosis
3) Patient with congenital kyphosis
2) Neurologic deficit is suspected as a result of kyphosis
5) All of the above
4) Patient with back pain and a history of osteoporosis

It is appropriate to obtain an MRI in all of the above circumstances. Magnetic resonance imaging allows a physician to evaluate the cerebrospinal fluid and spinal cord to localize the cause of a neurologic deficit. The presence of back pain in a patient with kyphosis and osteoporosis suggests the possibility of a vertebral compression fracture; these fractures may not always be seen with conventional radiographs. The use of MRI is recommended for the evaluation of a patient with congenital kyphosis to evaluate the morphology of the malformed segment and to rule out associated pathology.Correct Answer: All of the above

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2726. (3359) Q6-4242:

What percentage of women with osteoporotic fractures develop kyphosis:

1) 10%
3) 25%
2) 15%
5) 60%
4) 30%

Approximately 15% of women with osteoporotic fractures develop kyphosis. This is often due to the presence of multiple vertebral compression fractures with segmental kyphosis at each level.Correct Answer: 15%

2727. (3360) Q6-4243:

A 7-year-old boy presents to the emergency department (ED) with fever, headache, neck pain, nausea, vomiting, and mental status changes. The patient was involved in a motor vehicle accident in his parentâs car and experienced whiplash 4 weeks prior to his presentation at the ED. Laboratory studies show an elevated white blood cell (WBC) count and erythrocyte sedimentation rate (ESR). Which of the following statements concerning this patient is correct:

1) A lumbar puncture may reveal cerebral spinal fluid (CSF) with an increased number of neutrophils, decreased glucose content, and increased protein levels.
3) Radiographic findings for whiplash-related trauma may be negative in this patient.
2) A CSF culture may reveal *Haemophilus influenzae*.
5) All of the above
4) The patient should be admitted to the pediatric intensive care unit (PICU) and started on an intravenous antibiotic regimen.

The patient presented with the classic signs and symptoms of pediatric bacterial meningitis. Meningitis should be suspected in patients with neck pain, fever, and altered mental status. A lumbar puncture may show CSF with a high neutrophil count, high protein level, and decreased glucose; a CSF culture may reveal bacteria such as H influenzae. In children with a history of trauma, it is important to note that no radiographic findings may be present in 19% to 34% of patients. Because of the severity of the patientâs symptoms and diagnosis of bacterial meningitis, it is important to admit him to the PICU and begin intravenous antibiotics.Correct Answer: All of the above

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2728. (3361) Q6-4244:

Which of the following statements concerning neck pain is incorrect:

1) Patients with traumatic neck injury and pain must be stabilized and assessed with a full neurologic examination while immobilized.
3) Rest, physical therapy, and prolonged immobilization of the neck with a collar are effective in managing patients with neck pain.
2) Elderly patients may have symptoms of traumatic neck injury without a history of trauma.
5) Rest and physical therapy
4) Surgery for neck pain may be indicated for patients with a cervical spine fracture with evidence of instability, neoplastic disorders, spinal stenosis, and nerve root compression.

Choices A, B, D, and E are correct and are important considerations with managing a patient with neck pain. Rest and physical therapy are important and effective in treating neck pain. Prolonged immobilization of the neck with a collar, however, can result in deconditioning of the cervical paraspinal musculature, which can increase the patientâs risk for further neck injury.Correct Answer: Rest, physical therapy, and prolonged immobilization of the neck with a collar are effective in managing patients with neck pain.

2729. (3362) Q6-4245:

Schmorlâs nodes may be seen on radiographic studies in all of the following disorders except:

1) Spina bifida
3) Degenerative disk disease
2) Scheuermannâs kyphosis
5) Osteoporosis
4) Trauma

Schmorlâs nodes are seen in association with several disorders including Scheuermannâs kyphosis, degenerative disk disease, trauma, and osteoporosis. Schmorlâs nodes are not commonly seen in patients with spina bifida.Correct Answer: Spina bifida

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2730. (3363) Q6-4248:

All of the following are possible treatments for congenital or acquired torticollis except:

1) No treatment because spontaneous resolution is possible in cases of congenital torticollis
3) Holding infants so that chin is rotated toward the affected side
2) Active and passive stretching therapies in patients with congenital torticollis until puberty
5) Use botulinum toxin, hard collars, or braces in severe cases
4) Physical therapy with nonsteroidal anti-inflammatory drugs (NSAIDs) and use of a soft collar

Several treatment options exist for congenital and acquired torticollis. In very mild cases of congenital torticollis, the deformity may be self-limited and no therapy needs to be administered. Sometimes active and passive stretching of the neck can work well if performed before 1 year of life. Parents may hold the babyâs head so that the chin is rotated toward the affected side. Acquired torticollis can also be managed by physical therapy using NSAIDs and a soft collar. The use of botulinum toxin or braces can be a form of therapy in recalcitrant cases.Correct Answer: Active and passive stretching therapies in patients with congenital torticollis until puberty

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2731. (3364) Q6-4249:

What is the incidence of congenital torticollis in the general population:

1) 0.1% to 0.3%
3) 0.3 to 1.0%
2) 0.5% to 0.8%
5) 2% to 5%
4) 0.3% to 1.9%

Epidemiological studies have shown that the incidence of congenital torticollis is approximately 0.3% to 1.9% in the general population.Correct Answer: 0.3% to 1.9%

2732. (3381) Q6-4296:

Which of the following is a contraindication to kyphoplasty:

1) Local osteomyelitis
3) Sepsis
2) Osteoblastic lesions
5) All of the above
4) Bleeding diathesis

It is important to properly evaluate a patient prior to any surgical procedure. If a patient presents with osteomyelitis, osteoblastic lesions, sepsis, or bleeding diathesis, then surgery should be postponed until the underlying condition is corrected.Correct Answer: All of the above

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2733. (3382) Q6-4297:

Approximately how many vertebral compression fractures occur in the United States annually:

1) 70,000
3) 700,000
2) 500,000
5) 1.5 million
4) 1 million

There are approximately 700,000 reported vertebral compression fractures annually in the United States.Correct Answer: 700,000

2734. (3463) Q6-4397:

It is important to distinguish between acute or subacute vertebral compression fractures and old healed fractures radiographically. Which of the following can help distinguish an acute fracture from a chronic fracture:

1) T1-weighted magnetic resonance image (MRI)
3) Fat-suppressed T2-weighted MRI
2) T2-weighted MRI
5) Computed tomography (CT)
4) Dual energy X-ray absorptiometry (DEXA) scan

One can distinguish an acute or subacute vertebral compression fracture from an old, healed fracture by evaluating the fat-suppressed T2-weighted MRI or short tau inversion recovery (STIR) images. These images will show increased signal intensity suggesting an acute fracture. All of the other forms of imaging mentioned may also be used to evaluate the patient but are not the best techniques for differentiating an acute from a subacute fracture. DEXA scans are used to evaluate for osteoporosis. Although CT imaging provides excellent osseous detail, it may not allow for differentiation of an acute from a chronic fracture unless evidence of fracture healing is seen. Another method for evaluating the acuity of a vertebral compression fracture is a three-phase bone scan, which will demonstrate increased radiotracer activity at the site of an acute or subacute fracture.Correct Answer: Fat-suppressed T2-weighted MRI

2735. (3484) Q6-4424:

What is the prevalence of Schmorlâs nodes in the general population:

1) 3%
3) 10%
2) 7%
5) 19%
4) 15%

Approximately 10% of the population has Schmorlâs nodes, which are often completely benign.Correct Answer: 10%

2736. (3500) Q6-4450:

A 34-year-old man presents to the emergency department after sustaining a low-velocity gunshot wound to the upper back. Radiologic studies reveal bullet fragments scattered throughout the T6 to T8 levels. No evidence of instability is present on conventional radiographs and computed tomography. The patient was stabilized and a full neurologic examination was performed, revealing no major neurologic deficits. Management of this patient should consist of:

1) Removal of the bullet fragments from the T6 to T8 vertebral bodies
3) High-dose intravenous methylprednisolone administration for 24 hours
2) Removal of the bullet fragments from the T6 to T8 vertebral bodies and instrumented fusion from T4 to T10
5) Nonoperative treatment (eg, thoracolumbosacral bracing) and regular observation for progression of any neurologic deficits
4) Broad-spectrum antibiotic administration for 7 days

Removal of the bullet fragments from the T6 to T8 levels is not indicated because the patient does not have neurologic deficits and therefore does not require spinal cord decompression via bullet removal. Decompression via bullet removal for neural deficits in the thoracic spine has been shown to result in higher rates of complications compared with nonoperative management. High-dose steroid administration is not indicated in patients with gunshot wounds to the spine because the benefits of steroids are outweighed by the risks. The administration of broad-spectrum antibiotics is not indicated in this patient because the bullet did not pass through the gastrointestinal tract. Nonoperative management and regular observation for progression of neurologic deficits is important in this patient because of the localization of the bullet fragments to the thoracic spine, the lack of neurologic deficits, and the lack of instability.Correct Answer: Nonoperative treatment (eg, thoracolumbosacral bracing) and regular observation for progression of any neurologic deficits

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2737. (3502) Q6-4452:

A patient with slipped capital femoral epiphysis (SCFE) should have an endocrine workup if presenting with which of the following features:

1) Bilateral involvement
3) Age <10 or >15 years
2) Body mass index greater than the 95th percentile for age
5) Female gender
4) Negative family history

Endocrine workup is only indicated for age ,10 or .15 years, or stature less than the 10th percentile. Bilaterality, obesity, and negative family history are common findings in idiopathic SCFE. Although SCFE is more common in males, it is not uncommon in females.Correct Answer: Age <10 or >15 years

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2738. (3509) Q6-4461:

All of the following disorders can result in thoracic kyphosis measuring >40Âº except:

1) Ankylosing spondylitis
3) Klippel-Feil syndrome
2) Osteoporosis
5) Juvenile osteochondrosis
4) Tuberculosis

Klippel-Feil syndrome is a congenital disorder characterized by cervical fusion and malformation. It does not involve the thoracic spine. Conversely, ankylosing spondylitis, a sero-negative spondyloarthropathy, results in excessive kyphosis of the thoracic spine. Osteoporosis can result in kyphosis due to the presence of multiple vertebral compression fractures. Tuberculosis is also known to cause kyphosis due to involvement of the thoracic spine. Lastly, juvenile osteochondrosis, also known as Scheuermannâs kyphosis, is often associated with thoracic kyphosis.Correct Answer: Klippel-Feil syndrome

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2739. (3598) Q6-6462:

Occipitocervical fusion is often technically difficult in patients with rheumatoid arthritis due to all of the following reasons except:

1) Reduced bone quality
3) Persistent steroid use
2) Subaxial cervical instability
5) Frequent combination of both occipitocervical deformity and subaxial subluxation necessitating more extensive constructs
4) Occipital condyle fracture

Reduced bone quality is common in patients with rheumatoid arthritis. Steroid use may contribute to poor bone quality, impair bony fusion, and impede wound healing. The combination of occipitocervical deformity and subaxial subluxation may make individual patient constructs more extensive.Correct Answer: Occipital condyle fracture

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2740. (3599) Q6-6463:

The majority of studies confirm the presence of atlanto-axial subluxation (AAS) when:

1) Anterior atlantodental intervals (AADI) > 0 mm or posterior atlantodental intervals (PADI) < 18 mm
3) AADI > 2 mm or PADI ≤ 16 mm
2) AADI > 1 mm or PADI ≤ 14 mm
5) AADI > 4 mm or PADI ≤ 18 mm
4) AADI > 3 mm or PADI ≤ 14 mm

As described by Puttlitz and colleagues, AAS is defined as an AADI greater than 3 mm or a PADI less than 14 mm.Correct Answer: AADI > 3 mm or PADI ≤ 14 mm

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2741. (3600) Q6-6464:

The most common traumatic indications for occipitocervical fusion include type III occipital condyle fractures and:

1) Basilar invagination
3) Odontoid fracture
2) Atlanto-axial subluxation
5) C1-C2 instability
4) Atlanto-axial dissociation

Basilar invagination and atlanto-axial subluxation are more commonly present in degenerative disorders and less in trauma. Odontoid fractures are usually treated via C1-C2 fusion or odontoid screw fixation, although less commonly occipitocervical fusion is required. C1-C2 instability, similarly, is usually treated via C1-C2 stabilization. A more common traumatic indication for occipitocervical fusion is atlanto-axial dissociation.Correct Answer: Atlanto-axial dissociation

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2742. (3601) Q6-6465:

Occipitocervical fusion is indicated in all of the following situations except:

1) Diseased C1-C2 facet joints
3) C1-C2 instability with intact posterior arch of the atlas
2) C1-C2 instability with decompressive laminectomy
5) Atlanto-occipital instability
4) C1-C2 instability with fractured posterior arch of the atlas

An unstable C1-C2 segment, with intact posterior elements, may be treated via a C1-C2 fusion. If decompression is necessary or the posterior elements at C1-C2 are involved, then extension to the occiput may be necessary.Correct Answer: C1-C2 instability with intact posterior arch of the atlas

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2743. (3602) Q6-6466:

Approximately what percentage of individuals with rheumatoid arthritis will develop basilar invagination:

1) 1%
3) 5%
2) 3%
5) 20%
4) 10%

As per Sandhu and researchers, approximately 11% of patients with rheumatoid arthritis will eventually develop basilar invagination.Correct Answer: 10%

2744. (3986) Q6-8238:

Which approach(es) will provide access to the middle and anterior columns of the thoracic spine:

1) Posterior
3) Anterior and posterolateral (costotransversectomy)
2) Anterior (thoracotomy)
5) None of the above
4) Interlaminar

The anterior and posterolateral approaches provide access to the vertebral body (the anterior and middle columns of the spine) for performance of a corpectomy procedure, for example.

Correct Answer: Anterior and posterolateral (costotransversectomy)

2745. (4013) Q6-8265:

A 30-year-old man underwent an anterior lumbar discectomy and fusion at L4-L5 and L5-S1 through an anterior retroperitoneal approach 1 month ago. He now reports that he is unable to obtain and maintain an erection. The most likely cause of this condition is:

1) Disruption of the sympathetic nerves during anterior lumbar exposure
3) Not related to the surgical dissection
2) Traction on the parasympathetic nerve at the L4-L5 level
5) Sexual dysfunction secondary to retrograde ejaculation
4) Injury to the pudendal nerves in the anterior sacral region during dissection at the L5-S1 level

Sexual dysfunction is a common condition after extensive anterior lumbar surgical dissection. Erectile dysfunction is often nonorganic but may be related to parasympathetic injury. The parasympathetic nerves are deep in the pelvis at the level of S2-S3 and S3-S4 and are not usually involved in the surgical field for anterior L4-L5 and L5-S1 procedures. Retrograde ejaculation is the result of injury to the sympathetic chain on the anterior surface of the major vessels crossing the L4-L5 level and at the L5-S1 interspace. Erectile function and orgasm are not affected by sympathetic injury. The pudendal nerve is primarily a somatic nerve and is not located in the surgical field.

Correct Answer: Not related to the surgical dissection

2746. (4014) Q6-8266:

What percentage of patients with cervical myelopathy living in North America exhibit ossification of the posterior longitudinal ligament:

1) 1%
3) 10%
2) 5%
5) 50%
4) 25%

Although ossification of the posterior longitudinal ligament is considered most common in the Japanese population, 25% of North Americans with cervical myelopathy exhibit signs of this condition.

Correct Answer: 25%

2747. (4015) Q6-8267:

A 46-year-old patient with cervical myelopathy undergoes a multilevel posterior cervical laminectomy from C3 to C7. The risk of post laminectomy kyphosis is greatest with removal of which of the following structures:

1) More than 80% of the lamina
3) Interspinous ligament
2) More than 50% of each facet joint
5) Ligamentum flavum
4) Facet joint capsules

Post laminectomy kyphosis is often seen in patients who have removal of more than 50% of each facet joint or 100% of one facet joint. It is not commonly seen with removal of the ligamentum flavum or interspinous ligament. Less frequently, post laminectomy kyphosis is seen with removal of more than 80% of the lamina or excision of the facet joint capsules.

Correct Answer: More than 50% of each facet joint

2748. (153) Q7-204:

Which of the following variables is the most reliable predictor of poor outcome following arthroscopic debridement of an arthritic knee:

1) Presence of mechanical symptoms
3) Varus malalignment
2) Outerbridge grade IV chondromalacia
5) Duration of symptoms
4) Patient age

The presence of mechanical symptoms is a reliable predictor of successful outcome. Age has not been shown to reliably predict outcome following knee debridement. Although a prolonged duration of symptoms correlates with poor outcome, the presence of varus malalignment has a far more dismal prognosis.Correct Answer: Varus malalignment

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2749. (154) Q7-205:

Studies have shown that anterior cruciate ligament (ACL) deficiency may result in abnormal meniscal strain found particularly in what region:

1) Anterior horn of the lateral meniscus
3) Patellofemoral joint
2) Anterior horn of the medial meniscus
5) Posterior horn of the medial meniscus
4) Posterior horn of the lateral meniscus

While acute anterior cruciate ligament (ACL) injury alters the strain patterns in the lateral meniscus, chronic ACL insufficiency increases the strain in the medial meniscus and often results in tears of the posterior horn. In a study of 176 consecutive patients undergoing ACL reconstruction, there was an increasing incidence of meniscal tears as the ACL injury became more chronic with a significant increase in all medial meniscal tears and a relatively constant incidence of lateral meniscal tears.Correct Answer: Posterior horn of the medial meniscus

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2750. (155) Q7-207:

When comparing women to men, the NCAA Injury Surveillance System has demonstrated a higher rate of injury to what structure:

1) Patellar tendon
3) Posterior cruciate ligament (PCL)
2) Anterior cruciate ligament (ACL)
5) Medial collateral ligament
4) Posterolateral ligament complex

Anterior cruciate ligament injury has been observed to be 2 to 3 times more common in female basketball players than in their male counterparts. The higher risk of ACL injury in women may be related to laxity, larger Q angles, excessive pronation, increased hamstring flexibility, decreased notch width index, posture (less knee and hip flexion), and possible hormone influences.Correct Answer: Anterior cruciate ligament (ACL)

2751. (156) Q7-208:

After landing awkwardly on his flexed knee, a 22-year-old basketball player has immediate onset of pain and difficulty bearing weight. With the knee flexed 30Â°, examination reveals increased varus, external rotation, and posterior translation which decreases when the knee is flexed to 90Â°. The patient most likely has injured what structure(s):

1) Posterolateral complex
3) Posterior cruciate ligament
2) Posterolateral complex and posterior cruciate ligament
5) Posterior cruciate ligament and medial collateral ligament
4) Lateral collateral ligament

With an isolated injury to the posterior cruciate ligament (PCL), posterior translation increases at greater degrees of flexion demonstrating the greatest posterior translation at 90Â°. Injury to the lateral collateral ligament leads to varus laxity in 30Â° flexion without posterior translation. With an injury to the PCL and posterolateral complex, varus, external rotation, and posterior translation are detectable at 30Â° and increase as the knee is flexed to 90Â°. Isolated tears of the posterolateral complex lead to increased varus, external rotation, and posterior translation at 30Â° that decreases as the knee is flexed to 90Â° and the PCL tightens.Correct Answer: Posterolateral complex

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2752. (157) Q7-209:

When interference screws are used for femoral fixation during an endoscopic anterior cruciate ligament (ACL) reconstruction using autograft patellar tendon, how much divergence between the screw and bone plug is acceptable before pull-out strength is compromised to a clinically significant level:

1) 0Âº
3) 20Âº
2) 10Âº
5) 70Âº
4) 30Âº

Recent studies have indicated that nearly 40% of endoscopic anterior cruciate ligament reconstructions demonstrate screw-bone plug divergence. Divergence angles of less than 30Â° do not significantly alter pull-out strength clinically.Correct Answer: 30Âº

2753. (158) Q7-210:

The use of functional braces as part of a nonsurgical program for anterior cruciate ligament (ACL) insufficiency has been criticized primarily for what reason:

1) Most patients do not feel more stable in the brace.
3) The use of functional braces slows voluntary reaction time of the hamstring muscles.
2) Functional bracing does not limit anterior translation of the tibia in the ACL-deficient knee.
5) Functional bracing may prevent injury to the menisci.
4) Functional bracing increases stresses across the patellofemoral joint.

Using functional bracing in ACL-deficient knees has been shown to limit anterior translation of the tibia. Approximately two-thirds of patients feel more stable in a brace. Unfortunately, most braces slow voluntary reaction times of the hamstring muscles, which are important dynamic stabilizers of the joint. Patellofemoral stresses have not been shown to increase with the use of functional bracing.Correct Answer: The use of functional braces slows voluntary reaction time of the hamstring muscles.

2754. (159) Q7-212:

All of the following can lead to loss of motion following anterior cruciate ligament (ACL) reconstruction except:

1) Non-anatomic graft placement
3) Intercondylar notch scarring
2) Concomitant ligament surgery
5) Immobilization
4) Use of allograft patellar tendon

Etiologic factors for loss of motion following anterior cruciate ligament reconstruction include: intercondylar notch scarring, non-anatomic graft placement, capsulitis with ligament scarring or calcification, concomitant ligament surgery, immobilization, anterior nodule or Cyclops lesion, infection, and/or reflex sympathetic dystrophy. The use of allograft tissue has not been shown to increase the risk of arthrofibrosis.Correct Answer: Use of allograft patellar tendon

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2755. (4037) Q7-213:

Endurance training in athletes increases all of the following muscle properties except:

1) Hypertrophy (size) of type 1 fibers
3) Mass of connective tissue
2) Strength
5) Number of glycogen-producing enzymes
4) Number of mitochondria

Although fast-twitch muscle fibers (type II) undergo hypertrophy with high-resistance training, they do not increase in size with endurance training. Endurance training results in more efficient use of glycogen and an increased capacity for aerobic metabolism which, in turn, increases the number of mitochondria and glycogen-producing enzymes.Correct Answer: Hypertrophy (size) of type 1 fibers

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2756. (160) Q7-215:

The cell responsible for healing a meniscal tear is the:

1) Primitive mesenchymal cell
3) Monocyte
2) Fibrochondrocyte
5) Synovial type B cell
4) Synovial type A cell

The fibrochondrocyte is the cell responsible for meniscal healing. Synovial type A cells are important in phagocytosis. Synovial type B cells produce synovial fluid. The target cell for bone morphogenic protein is the undifferentiated perivascular mesenchymal cell.Correct Answer: Fibrochondrocyte

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2757. (161) Q7-216:

All of the following structures have attachment to the medial femoral condyle except the:

1) Adductor magnus
3) Superficial medial collateral ligament
2) Medial head of the gastrocnemius
5) Popliteus
4) Patellofemoral ligament

The popliteus attaches to the posterior aspect of the lateral femoral condyle. All of the other mentioned structures attach to the medial femoral condyle: the adductor magnus superiorly, the superficial medial collateral ligament and the gastrocnemius inferiorly, and the medial patellofemoral ligament anteriorly deep to the vastus medialis.Correct Answer: Popliteus

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2758. (162) Q7-217:

In anterior cruciate ligament (ACL) rehabilitation, closed-chain kinetic exercises are associated with all of the following except:

1) Allow for co-contraction of the musculature around the knee
3) Allow hip muscular activity for stability
2) Stabilize the foot
5) Improve aerobic power and endurance in the leg
4) Apply physiologic compressive loads to the knee

Closed-chain exercises for the lower extremity have been shown to be effective following anterior cruciate ligament reconstruction for several reasons. They allow co-contraction of the muscles crossing the knee, stabilize the foot against resistance, apply compressive loads to the knee, and allow for hip motion for stability. Such exercises have not been shown to have any effect on the aerobic capacity of the leg.Correct Answer: Improve aerobic power and endurance in the leg

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2759. (163) Q7-218:

A 24-year-old cross-country runner complains of anterior knee pain after running. Palpation reveals point tenderness at the inferior pole of the patella. Range of motion is full and exam demonstrates no patellofemoral crepitus. Management should include:

1) Cortisone injection into the site of tenderness
3) Nonsteroidal anti-inflammatory medication and quadriceps stretching exercises
2) Use of a knee immobilizer for 6 weeks
5) Open patellar tendon debridement
4) Arthroscopic lateral release

This scenario is consistent with infrapatellar tendinitis (jumperâs knee), which is common in runners and jumpers. The mechanism often involves chronic overloads of the tendon. Anti-inflammatory medication may alleviate symptoms while quadriceps stretching decreases the load on the tendon by increasing the resting length of the muscle-tendon unit. Open patellar tendon debridement should be reserved for cases of chronic tendonitis that are refractory to conservative management.Correct Answer: Nonsteroidal anti-inflammatory medication and quadriceps stretching exercises

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2760. (164) Q7-219:

To be considered for repair, a meniscal tear must fulfill all of the following criteria except:

1) The tear should be longer than 10 mm.
3) The torn segment must be minimally damaged.
2) The tear must be contained entirely within the vascular zone.
5) The tear should not be degenerative.
4) A peripheral rim of meniscal tissue must exist.

Meniscal repair is now recognized as an effective treatment method for certain types of meniscal tears. To be considered for repair, a meniscal tear must be long enough to cause instability of the torn portion (usually longer than 10 mm). The tear should also be within the vascular zone of the mensicus where healing is most likely to occur. There must also be minimal damage to the torn segment. In general, meniscal tears in older patients tend to be degenerative in nature, precluding a successful repair. Although the peripheral tissue must be minimally damaged for a successful repair, the presence of meniscal tissue peripherally is not necessary prior to considering repair.Correct Answer: The tear should not be degenerative.

2761. (165) Q7-220:

In which of the following anatomic locations have authors described a characteristic MRI edema pattern lesion that occurs with an acute anterior cruciate ligament (ACL) injury:

1) Posterolateral aspect of the tibia and the middle aspect of the lateral femoral condyle
3) Lateral patellar facet and lateral trochlear groove
2) Posterolateral aspect of the tibia and the posteriar aspect of the lateral femoral condyle
5) Posteromedial aspect of the tibia and the anteromedial aspect of the lateral femoral condyle
4) Anterolateral aspect of the tibia and the posterolateral aspect of the lateral femoral condyle

During anterior cruciate ligament (ACL) injury, anterior translation of the tibia and the associated valgus force create a compressive load on the articular cartilage in the posterolateral aspect of the tibia and the anterolateral aspect of the lateral femoral condyle. It has been estimated that approximately 80% of acute ACL injuries demonstrate this pattern on magnetic resonance imaging.Correct Answer: Posterolateral aspect of the tibia and the middle aspect of the lateral femoral condyle

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2762. (166) Q7-221:

Six days following anterior cruciate ligament (ACL) reconstruction, a patient returns for follow-up with a fever of 102Â° F, local incisional drainage, painful decreased knee motion, effusion, erythema, and warmth in the knee. Aspiration of the knee reveals cloudy, blood-tinged synovial fluid. A white blood cell count of the aspirate was 60,000 with 85% polymorphonuclear cells. Appropriate management at this time should include:

1) Admission to the hospital and administration of IV antibiotics.
3) Immediate arthroscopic lavage with incision and drainage of all associated wounds.
2) Starting the patient on oral antibiotics followed by careful outpatient observation over the next several days.
5) Immediate arthroscopic lavage with incision and drainage of all associated wounds, partial synovectomy, and debridement with graft retention.
4) Immediate arthroscopic lavage with incision and drainage of all associated wounds, partial synovectomy, and graft debridement.

Although reported infection rates following anterior cruciate ligament (ACL) reconstruction are as low as 0.3%, the treatment of septic arthritis in the early postoperative period can be challenging. In a patient with a suspected infection, immediate arthroscopic lavage with debridement of necrotic tissue and partial synovectomy is paramount. In a recent review of 831 arthroscopically guided ACL reconstructions, McAllister and associates reported complete resolution of all four infected cases with early lavage, debridement, and graft retention followed by IV, then oral antibiotics. However, the clinical outcome of these patients was inferior to that of patients who had undergone uncomplicated ACL reconstruction due to the damage of the articular cartilage as a result of the infection.Correct Answer: Immediate arthroscopic lavage with incision and drainage of all associated wounds, partial synovectomy, and debridement with graft retention.

2763. (167) Q7-222:

In a congruent patellofemoral joint, the patella centers within the trochlear groove by what degree of flexion:

1) 5Â° to 10Â°
3) 15Â° to 20Â°
2) 10Â° to 15Â°
5) 25Â° to 30Â°
4) 20Â° to 25Â°

Laurin and colleagues recognized that the normally tracking patella centered within the trochlea by 20Â° of knee flexion. Fulkerson and Hungerford demonstrated patellar engagement between 15Â° to 20Â° using computerized tomography scans.Correct Answer: 15Â° to 20Â°

2764. (168) Q7-226:

Which of the following statements correctly describes the relationship of screw length to pull-out strength in anterior cruciate ligament (ACL) fixation using hamstring tendon graft fixation with soft tissue interference screws:

1) Use of a longer screw provides stronger fixation strength.
3) Fixation strength has not been shown to be affected by screw length.
2) A small diameter screw provides stronger fixation strength.
5) Better fixation is achieved with larger bone tunnel diameter.
4) The best fixation is achieved with a long screw and aperture fixation.

A recent study compared the cyclic and time-zero pull-out forces of 7 Ã 25 mm and 7 Ã 40 mm blunt-threaded metal interference screws for hamstring graft tibial fixation in 8 paired human cadaveric specimens. There were no measurable differences in the mean cyclic failure strength, pull-out strength, or stiffness between the 2 sizes of screws. One potential advantage of using a longer screw is the relative ease with which it can be removed compared with a shorter screw should revision surgery become necessary.Correct Answer: Fixation strength has not been shown to be affected by screw length.

2765. (169) Q7-227:

Which of the following statements concerning allograft use in anterior cruciate ligament (ACL) reconstruction is incorrect:

1) Allograft sterilization using gamma irradiation has not been shown to adversely affect its tensile properties.
3) Allograft use diminishes postoperative pain.
2) Allograft use avoids donor site morbidity.
5) Allograft incorporation is slower than autograft.
4) Allograft use decreases surgical time.

Secondary sterilization is achieved with the use of ethylene oxide or gamma irradiation, both of which have detrimental effects on the allograft. Ethylene oxide residues remain on the tissue and stimulate an intra-articular reaction. Gamma radiation has been shown to decrease structural and mechanical properties of the tissue. Irradiation also alters the collagen morphology of sterilized tissues. Currently, the most accepted method of allograft sterilization involves sterile harvesting and deep freezing.Correct Answer: Allograft sterilization using gamma irradiation has not been shown to adversely affect its tensile properties.

2766. (170) Q7-228:

Which of the following choices represents the correct order of layers in the direct insertion of a human ligament:

1) Bone, uncalcified fibrocartilage, calcified fibrocartilage, and ligament
3) Bone, hypertrophic layer, fibrous layer, and ligament
2) Bone, fibrous layer, hypertrophic layer, and ligament
5) Bone, calcified fibrous layer, uncalcified fibrous layer, and ligament
4) Bone, calcified fibrocartilage, uncalcified fibrocartilage, and ligament

Histologic sectioning of a direct ligament insertion of rotator cuffs in cadavers demonstrates 4 discrete layers: ligament, uncalcified fibrocartilage layer, calcified fibrocartilage layer, and bone. Some authors have suggested that the uncalcified fibrocartilage ensures that the tendon fibers do not compress at a hard tissue interface.Correct Answer: Bone, calcified fibrocartilage, uncalcified fibrocartilage, and ligament

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2767. (171) Q7-229:

When describing patellar instability, which of the following is the correct relationship between maltracking and malalignment:

1) Maltracking describes the bony anatomy, while malalignment describes the soft tissue anatomy.
3) Malalignment refers to the patellar articulation only.
2) Maltracking refers to the patellar articulation only.
5) Malalignment describes a static relationship, while maltracking describes a dynamic relationship.
4) Malalignment refers to passive instability, while maltracking refers to active instability.

Terminology describing the setting for patellar instablility can be confusing when the terms âmalalignment,â âmaltracking,â and âinstabilityâ are used interchangeably. Malalignment is an abnormal static relationship between the patella, its associated soft tissues, and the femoral and tibial axes. Maltracking is an expression of the dynamic relationships of these components and is noted during both active and passive motion.Correct Answer: Malalignment describes a static relationship, while maltracking describes a dynamic relationship.

2768. (172) Q7-230:

Which of the following findings has not been reported following abrasion arthroplasty as treatment for the painful, arthritic knee:

1) An increase of the medial joint space on radiograph
3) Formation of a fibrocartilage articular surface
2) Intermediate or long-term symptomatic improvement in the majority of patients
5) Worsening of symptoms in 10% to 20% of patients
4) Formation of primarily type I collagen

Although popular in the 1980s, abrasion arthroplasty for the treatment of osteoarthritis of the knee has not been shown to reliably improve patientsâ symptoms. Although some authors have found radiographic evidence of an increased joint space in approximately 50% of patients, these findings have not corresponded to an improvement in symptomatology. Abrasion arthroplasty results in the formation of a fibrocartilaginous articular surface that varies in composition with immature type I collagen predominant.Correct Answer: Intermediate or long-term symptomatic improvement in the majority of patients

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2769. (173) Q7-231:

Which of the following anatomic landmarks of the knee represents the contact area between the lateral femoral condyle and the anterior horn of the lateral meniscus when the knee is in full extension:

1) Outerbridgeâs ridge
3) Notch of Grant
2) Blumensattâs line
5) Sulcus terminalis
4) Davidâs point

The indentation on the lateral femoral condyle often seen on the lateral radiograph of the knee represents the contact area between the femoral condyle and the anterior portion of the lateral meniscus and is often referred to as the sulcus terminalis. After an acute anterior cruciate ligament (ACL) injury or recurrent giving way episode in a chronically ACL deficient knee, the sulcus terminalis is the region in which a bone contusion is typically seen on an magnetic resonance image.Correct Answer: Sulcus terminalis

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2770. (174) Q7-232:

Following tibial eminence fractures in skeletally-immature patients, all of the following sequelae have been described except:

1) Residual anterior cruciate ligament laxity
3) Loss of knee flexion
2) Osteophytes near the tibial spine
5) Loss of terminal knee extension
4) Hypertrophy of the tibial spine

The overall results following adequate reduction of the tibial spine are good to excellent. Loss of terminal knee extension is thought to occur due to hyperemia, subsequent hypertrophy or displacement of the tibial spine and resultant bony blockage.Correct Answer: Loss of knee flexion

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2771. (175) Q7-233:

Which of the following initial treatment regimens is most appropriate for a 12-year-old boy with osteochondritis dissecans and no effusion or mechanical symptoms:

1) Arthroscopic fixation of the lesion
3) Moderation of activities
2) Arthroscopic drilling of the lesion
5) Arthroscopic synovectomy and debridement
4) Arthroscopic removal of loose bodies

Arthroscopic treatment of osteochondritis dissecans is limited to those patients with mechanical symptoms, effusion, and/or radiographic evidence of loose bodies in the joint. Osteochondritis of the femoral condyle may well heal with moderation of activities.Correct Answer: Moderation of activities

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2772. (176) Q7-234:

Which of the following radiographic views allows the best visualization of the acromioclavicular (AC) joint:

1) Stryker notch view
3) Garth view
2) Zanca view
5) Anteroposterior shoulder view
4) Serendipity view

In addition to standard views, a 10Â° cephalic tilt (Zanca) view is helpful to evaluate anteroposterior arthritis or distal clavicle osteolysis. This view is taken with approximately half the voltage of a standard anteroposterior shoulder radiograph and allows an unobstructed look at the acromioclavicular joint without soft tissue or bony overlay.

- The Stryker notch radiograph allows visualization of a Hill-Sachs impression fracture of the posterior humeral head.
- The glenoid fossa, or Garth view, is a true anteroposterior of the glenohumeral joint with the radiograph beam directed 45Â ° from the plane of the thorax.
- The Serendipity view is used to evaluate the sternoclavicular joint and is a 40Â° cephalic tilt view with the patient supine.

Correct Answer: Zanca view

2773. (177) Q7-235:

Following two previous shoulder stabilization procedures for recurrent dislocations, a 45-year-old man complains of pain and limited motion. Examination reveals increased passive external rotation and an inability to lift the back of the hand away from his back. Which of the following muscles is injured:

1) Subscapularis
3) Infraspinatus
2) Supraspinatus
5) Teres minor
4) Deltoid

The patient has an incompetent subscapularis muscle. An inability to lift the back of the hand away from the back (a positive Lift-off test) has been described by Gerber and colleagues and is a reliable method of evaluating subscapularis integrity. Patients with subscapularis tears often demonstrate an increase in passive external rotation and weakness in internal rotation.Correct Answer: Subscapularis

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2774. (178) Q7-236:

Which of the following structures provides static restraint to anterior humeral head translation in relation to the glenoid at 90Â° of abduction and external rotation:

1) Subscapularis muscle
3) Superior glenohumeral ligament
2) Supraspinatus muscle
5) Inferior glenohumeral ligament
4) Middle glenohumeral ligament

Biomechanics studies have demonstrated that the anterior band of the inferior glenohumeral ligament (IGHL) provides the primary static restraint to anterior shoulder translation. Neither the subscapularis nor the supraspinatus provides static restraint to the glenohumeral joint.Correct Answer: Inferior glenohumeral ligament

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2775. (179) Q7-237:

Which of the following is not a cause of failure following arthroscopic subacromial decompression:

1) Error in diagnosis
3) Reconstitution of bursal tissue
2) Detachment of the deltoid
5) Retained coracoacromial (CA) ligament
4) Inadequate bone resection

Causes of failure following arthroscopic decompression are similar to the causes of failure following open acromioplasty. Numerous studies have documented errors in diagnosis as the most common cause of failure. Inadequate bone resection can also cause continued pain and dysfunction. A retained coracoacromial ligament attachment can decrease the volume in the subacromial space and lead to recurrent impingement. Although bursal tissue can reconstitute following partial excision, this has not been shown as a common cause of failure following decompression. Deltoid detachment may cause weakness and pain.Correct Answer: Reconstitution of bursal tissue

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2776. (180) Q7-238:

Which of the following structures is involved in the âessential lesionâ of a stiff shoulder:

1) Biceps tendon
3) Posterior capsule
2) Coracohumeral ligament
5) Axillary pouch
4) Labrum

The long head of the biceps tendon defines the region of the rotator interval, which is the area between the anterior edge of the supraspinatus tendon and the superior edge of the subscapularis tendon. This region usually is contracted in individuals who lack external rotation of the adducted shoulder. Coracohumeral ligament contracture is an important component of adhesive capsulitis.Correct Answer: Coracohumeral ligament

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2777. (181) Q7-240:

A 35-year-old businessman sustains a type III acromioclavicular (AC) separation of his dominant shoulder. Preferred treatment should be:

1) Open subacromial decompression with distal clavicle resection
3) Repair of coracoacromial ligament and fixation with a Bosworth screw
2) Arthroscopic subacromial decompression
5) Reduction of the AC joint and stabilization with pins
4) Symptomatic treatment followed by return to activities as tolerated

Long-term outcome studies have demonstrated good and excellent results following symptomatic, nonsurgical treatment of grade I-III acromioclavicular separations. Surgical treatment may lead to complications (especially with the use of transfixing smooth pins), loss of reduction, and chronic pain due to joint instability.Correct Answer: Symptomatic treatment followed by return to activities as tolerated

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2778. (182) Q7-241:

Which of the following muscles is most responsible for deceleration of the arm during pitching:

1) Deltoid
3) Teres minor
2) Coracobrachilis
5) Short head of the biceps
4) Long head of the biceps

During the deceleration phase, the excess kinetic energy that was not transferred to the ball is dissipated by controlled deceleration of the upper extremity. The rotator cuff (primarily teres minor) is the principle decelerator and is susceptible to tensile failure from eccentric loading.Correct Answer: Teres minor

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2779. (183) Q7-242:

Which of the following is the definition of internal impingement of the shoulder:

1) Impingement of the under surface of the rotator cuff against the posterosuperior glenoid labrum
3) Impingement of the bursal-surface of the rotator cuff against a prominent acromion
2) Impingement of the under surface of the rotator cuff against the anterior glenoid labrum
5) Impingement of the rotator cuff against an intra-articular loose body
4) Impingement of the bursal-surface of the rotator cuff against a hypertrophied coracoacromial ligament

When a shoulder is placed in a position of abduction and external rotation, the rotator cuff can impinge against the posterosuperior glenoid labrum. This phenomenon has recently been the explanation for pain when the apprehension test is performed. A positive relocation test occurs when this discomfort is relieved by posterior translation of the humeral head.Correct Answer: Impingement of the under surface of the rotator cuff against the posterosuperior glenoid labrum

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2780. (184) Q7-243:

Which of the following conditions most often accompanies a dislocation of the longhead of the biceps tendon?

1) Anterior instability
3) Subscapilars tendon pathology or tear
2) Presence of a Buford complex
5) Excessive glenoid anteversion
4) Hill-Sachs lesions

Although âisolatedâ ruptures of the biceps tendon have been described, most cases involving biceps tendon pathology are accompanied by rotator cuff injury. When computerized tomography arthrograms are performed on patients who have clinical criteria for isolated ruptures of the long head of the biceps, the incidence of isolated lesions decreases to 6%. Although primary bicipital tendinitis was recognized as a frequent cause of anterior shoulder pain in the 1950s, it is currently a diagnosis of exculsion that is made far less frequently.Correct Answer: Subscapilars tendon pathology or tear

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2781. (185) Q7-245:

Which of the following combinations correctly describes the contributions of the acromioclavicular ligaments and coracoclavicular ligaments in stabilizing the acromioclavicular joint:

1) Horizontal stability is controlled by the coracoacromial ligament.
3) Horizontal stability is controlled by the coracoclavicular ligament and vertical stability is controlled by the acromioclavicular ligament.
2) Vertical stability is controlled by the acromioclavicular ligament.
5) Horizontal stability is controlled by the acromioclavicular ligament and vertical stability is controlled by the coracoclavicular ligament.
4) Horizontal stability is controlled by the coracoacromial ligament and vertical stability is controlled by the acromioclavicular ligament.

Fuduka and colleagues have studied the individual ligamentous contributions to acromioclavicular stability by performing load displacement tests on sectioned cadaveric models. These experiments led to the conclusion that the horizontal stability of the acromioclavicular joint is controlled by the acromioclavicular ligament and vertical stability is controlled by the coracoclavicular ligament.Correct Answer: Horizontal stability is controlled by the acromioclavicular ligament and vertical stability is controlled by the coracoclavicular ligament.

2782. (230) Q7-340:

Which of the following statements is true concerning the bands of the anterior cruciate ligament:

1) The anterolateral band is tightest in flexion.
3) The posteromedial band is tightest in extension.
2) The posterolateral band is tightest in flexion.
5) The anteromedial band is tightest in extension.
4) The anteromedial band is tightest in flexion.

The anterior cruciate ligament is composed of at least two functional bands. The larger anteromedial band is tightest in flexion and loosest in extension. The smaller posterolateral band is tightest in extension and loosest in flexion. Conventional anterior cruciate ligament reconstruction replaces only the anteromedial band.Correct Answer: The anteromedial band is tightest in flexion.

2783. (234) Q7-345:

Which of the following statements is true concerning the bands of the posterior cruciate ligament:

1) The anterolateral band is tightest in flexion.
3) The posteromedial band is tightest in flexion.
2) The posterolateral band is tightest in flexion.
5) The anteromedial band is tightest in extension.
4) The anteromedial band is tightest in flexion.

The posterior cruciate ligament is composed of two functional bands. The larger anterolateral band is tightest in flexion and loosest in extension. The smaller posteromedial band is tightest in extension and loosest in flexion. Conventional posterior cruciate ligament reconstruction replaces only the anterolateral band.Correct Answer: The anterolateral band is tightest in flexion.

2784. (235) Q7-346:

The most sensitive test for posterior cruciate ligament injury is the:

1) Posterior drawer test
3) Posterior sag sign
2) Quadriceps active drawer test
5) Dynamic posterior shift test
4) Posterior Lachman test

All of the above tests have been described for evaluating posterior cruciate ligament injury. Of these tests, the posterior drawer test is the most sensitive(95%).Correct Answer: Posterior drawer test

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2785. (236) Q7-347:

In a pitcher with an ulnar collateral ligament injury of his dominant elbow, pain is generally most severe during:

1) Wind-up
3) Late cocking
2) Early cocking
5) Rest following activity
4) Follow-through

With ulnar collateral ligament injury, pain is usually exacerbated during the late cocking and the acceleration phases of throwing when the stresses on the ulnar collateral ligament are greatest.Correct Answer: Late cocking

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2786. (237) Q7-348:

A 30-year-old male avid runner presents with a 2-week history of right lateral knee pain. He denies any history of trauma, swelling, or mechanical symptoms. The pain only occurs with running and is relieved by cessation of activity. Physical examination does not demonstrate any effusion, and there is no pathologic laxity of the collateral or cruciate ligaments. There is tenderness to palpation along the lateral aspect of the knee that is most severe over the lateral epicondyle, particularly with the knee flexed to 30Â°. The next most appropriate course of action is:

1) Obtain an magnetic resonance image
3) Arthroscopic debridement of the right lateral meniscus
2) Steroid injection to the right knee
5) Stretching of the right iliotibial band, temporary decrease in mileage, and anti-inflammatory medication
4) Arthroscopic repair of the right lateral meniscus

The patient has iliotibial band friction syndrome, which is common in runners. Physical therapy is successful in the majority of patients. Rarely, debridement of an ellipse of the iliotibial band will be required to provide relief.Correct Answer: Stretching of the right iliotibial band, temporary decrease in mileage, and anti-inflammatory medication

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2787. (238) Q7-349:

Figure 1

This radiograph shows a diaphysis of a 21-year-old female collegiate soccer player. She reports pain in the midshaft of her tibia for 7 months. She has been previously treated with cessation of soccer, 8 weeks in a short leg cast, and 3 months of treatment with an ultrasonic bone stimulator. Recommended treatment at this time should include:

1) Observation
3) Application of a short leg case
2) Application of a long leg cast
5) Insertion of a reamed intramedullary nail
4) Continued treatment with an ultrasonic bone stimulator

The tibia is the bone most prone to stress fractures in athletes. The appearance of the "dreaded black line" is a poor prognostic indicator for healing. Since this patient has failed nonoperative treatment, insertion of a reamed intramedullary nail would offer her the best chance of healing and earlier return to activity.Correct Answer: Insertion of a reamed intramedullary nail

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2788. (239) Q7-350:

A "stinger" (transient weakness of the upper extremity commonly seen after a blow to the head and shoulder in football) most commonly affects the:

1) Spinal cord
3) C-7/C-8 nerve roots
2) C-5/C-6 nerve roots
5) Musculocutaneous nerve
4) Axillary nerve

"Stingers" are common in football. They generally result from a transient stretch to the C-5/C-6 nerve roots resulting in temporary loss of strength of the biceps, deltoid, and spinatus muscles. It is generally safe to allow the athlete to return to participation, provided the cervical spine examination is normal and any neurological deficits have completely resolved.Correct Answer: C-5/C-6 nerve roots

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2789. (240) Q7-351:

A 16-year-old male high school football player was making a tackle when he felt sudden pain in his right long finger. He has swelling and tenderness along the volar aspect of the injured digit. He is unable to actively flex the distal interphalangeal joint of the injured digit. Radiographs are negative for fracture. Recommended treatment should include:

1) Observation
3) Splinting of the distal interphalangeal joint in flexion
2) Splinting of the distal interphalangeal joint in extension
5) Surgical repair
4) Immediate active range of motion exercises

Avulsion of the flexor digitorum profundus, or "jersey finger," is a common injury in football. Appropriate treatment includes surgical repair.Correct Answer: Surgical repair

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2790. (241) Q7-352:

Catastrophic cervical spine injuries occurring during contact sports are most commonly a result of:

1) Hyperflexion
3) Flexion/compression
2) Hyperextension
5) Distraction
4) Rotation

Catastrophic injury of the cervical spine resulting in paralysis or death usually occurs from an axial loading mechanism, such as "spear" tackling in football. Controversy exists as to whether cervical spinal stenosis is a predisposing factor for catastrophic cervical spine injuries.Correct Answer: Flexion/compression

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2791. (242) Q7-354:

A collegiate level sprinter sustains an acute nondisplaced fracture at the proximal metaphyseal-diaphyseal junction of the fifth metatarsal. Appropriate treatment for early return to play includes:

1) Observation
3) Short leg non-weightbearing cast
2) Short leg walking cast
5) Compression screw fixation
4) Application of an ultrasonic bone stimulator

Fractures of the metaphyseal-diaphyseal junction of the fifth metatarsal base, the Jones fracture, is treated more aggressively than its avulsed counterpart. In the acute situation, these fractures are treated in a non-weightbearing cast until union is obtained. Occasionally, an elite athlete will sustain a Jones fracture. It is important to determine whether this represents an acute injury or a stress fracture. Stress fractures are treated initially with non-weightbearing until union occurs and symptoms resolve. Acute Jones fractures in the athlete are best treated with compression screw fixation with bone graft to insure healing in a timely manner.Correct Answer: Compression screw fixation

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2792. (243) Q7-355:

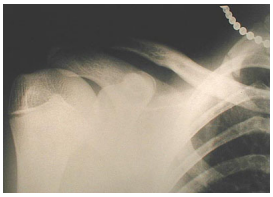

Figure 1

This is the radiograph of a right hand dominant 15-year-old baseball player who felt a pop when swinging a bat. There is pain in the upper portion of the first rib. Recommended treatment should consist of:

1) Immobilization in a shoulder spica cast
3) Open reduction internal fixation with bone graft
2) Immobilization in a sling
5) Observation
4) Open biopsy

First rib fractures in athletes are rare. These fractures are thought to be stress fractures, usually occurring in pitchers. Treatment is observation until the fracture is healed.Correct Answer: Observation

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2793. (244) Q7-356:

A 10-year-old female gymnast twists her knee on her dismount from the balance beam. She hears a pop and has immediate swelling. She is unable to continue with activity. Physical examination reveals a positive Lachman test and positive pivot shift. She has no joint line tenderness. Radiographs are normal. After an initial period of ice and range of motion exercises, recommended treatment should include:

1) Direct repair of the anterior cruciate ligament
3) Reconstruction of the anterior cruciate ligament using hamstrings
2) Reconstruction of the anterior cruciate ligament using patellar tendon
5) Rehabilitation emphasizing hamstring strengthening
4) Extra-articular reconstruction

Anterior cruciate ligament injuries in children represent a vexing clinical problem. Standard anterior cruciate ligament reconstructions would involve drilling across an open physis, which may cause a growth disturbance. Results of direct repair or extra-articular reconstruction have been no better in children than in adults. The most reasonable initial treatment is rehabilitation. If despite adequate rehabilitation, the child continues to have instability, it is recommended that the child discontinues the activities that result in instability until skeletal maturity when a standard reconstruction can be performed, or when the child undergoes a physeal sparing reconstruction (i.e., Bergfeld's "tomato stake" reconstruction).Correct Answer: Rehabilitation emphasizing hamstring strengthening

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2794. (245) Q7-357:

The most common location of osteochondritis dissecans in the knee is the:

1) Lateral aspect of the medial femoral condyle
3) Medial aspect of the medial femoral condyle
2) Medial aspect of the lateral femoral condyle
5) Lateral aspect of the femoral trochlea
4) Lateral facet of the patella

Osteochondritis dissecans affects adolescents, and the knee joint is the most commonly affected joint. The most common location in the knee is the lateral aspect of the medial femoral condyle at the intercondylar notch. Treatment varies with the stability of the lesion from observation to operative reduction and fixation.Correct Answer: Lateral aspect of the medial femoral condyle

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2795. (246) Q7-358:

A 15-year-old female volleyball player twisted her knee while planting her foot. She states she felt her knee give out. She had immediate swelling and was unable to continue participation. She denies hearing a pop. Physical examination reveals a large effusion with a range of motion from full extension to 80Â° flexion. She has marked tenderness along the medial retinaculum of her knee. She has no joint line tenderness. There is no pathologic laxity involving the collateral or cruciate ligaments. The most likely diagnosis is:

1) Partial anterior cruciate ligament tear
3) Medial collateral ligament sprain
2) Posterior cruciate ligament tear
5) Peripheral medial meniscal tear
4) Patellar subluxation

Patellar subluxation is a common injury in athletes. It generally presents with a large effusion. Patients usually have a limited arc of motion but can usually obtain full extension. In addition to medial retinacular tenderness, patients will have apprehension to attempts at lateral displacement of the patella. Treatment is initially nonoperative, emphasizing quadriceps strengthening. Operative treatment is reserved for patients with continued instability despite appropriate rehabilitation.Correct Answer: Patellar subluxation

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2796. (247) Q7-359:

The primary restraint to anterior translation of the abducted and externally rotated glenohumeral joint is the:

1) Coracohumeral ligament
3) Middle glenohumeral ligament
2) Superior glenohumeral ligament
5) Subscapularis muscle
4) Inferior glenohumeral ligament

The inferior glenohumeral ligament is the primary restraint to anterior translation of the abducted and externally rotated glenohumeral joint. The Bankart lesion is an avulsion of the inferior glenohumeral ligament and represents the primary pathoanatomy of traumatic anterior shoulder dislocation.Correct Answer: Inferior glenohumeral ligament

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2797. (248) Q7-360:

The quadriceps angle or Q angle is defined as the angle formed by a line connecting the:

1) Anterior inferior iliac spine to the center of the patella and a line connecting the center of the patella to the center of the tibial tuberosity
3) Anterior inferior iliac spine to the lateral aspect of the patella and a line connecting the center of the patella to the center of the tibial tuberosity
2) Anterior superior iliac spine to the center of the patella and a line connecting the center of the patella to the center of the tibial tuberosity
5) Anterior inferior iliac spine to the center of the patella and a line connecting the center of the patella to the center of the ankle
4) Anterior superior iliac spine to the center of the patella and a line connecting the center of the patella to the center of the ankle

The quadriceps angle, or Q angle, is used to evaluate patellofemoral alignment. It is defined as the angle formed by a line connecting the anterior superior iliac spine to the center of the patella and a line connecting the center of the patella to the center of the tibial tuberosity. A normal angle is up to 10Â° in men and up to 15Â° in women. Unfortunately, no standard technique exists for measuring the Q angle, and its reliability and usefulness have recently come under question.Correct Answer: Anterior superior iliac spine to the center of the patella and a line connecting the center of the patella to the center of the tibial tuberosity

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2798. (249) Q7-361:

Innervation to the anterior cruciate ligament is provided by a branch of the:

1) Sciatic nerve
3) Saphenous nerve
2) Obturator nerve
5) Femoral nerve
4) Posterior tibial nerve

The posterior articular branch of the posterior tibial nerve provides pain fibers and mechanoreceptors to the anterior cruciate ligament.Correct Answer: Posterior tibial nerve

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2799. (250) Q7-362:

All of the following represent mechanisms of injury to the posterior cruciate ligament except:

1) Posteriorly directed force on the anterior aspect of the flexed knee
3) Valgus force applied to a flexed and externally rotated knee
2) Fall onto a flexed knee
5) Hyperextension
4) Hyperflexion

All of the above except application of valgus force to a flexed and externally rotated knee have been described in posterior cruciate ligament injuries. Application of a valgus force to a flexed and externally rotated knee would more likely result in an anterior cruciate ligament injury.Correct Answer: Valgus force applied to a flexed and externally rotated knee

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2800. (251) Q7-363:

Which of the following sets of compartment measurements confirms the diagnosis of exertional compartment syndrome:

1) Preexercise >10 mm Hg, 1-minute postexercise >20 mm Hg, 5-minute postexercise >15 mm Hg
3) Preexercise >20 mm Hg, 1-minute postexercise >20 mm Hg, 5-minute postexercise >20 mm Hg
2) Preexercise >15 mm Hg, 1-minute postexercise >30 mm Hg, 5-minute postexercise >20 mm Hg
5) Preexercise >15 mm Hg, 1-minute postexercise >30 mm Hg, 5-minute postexercise >10 mm Hg
4) Preexercise >10 mm Hg, 1-minute postexercise >30 mm Hg, 5-minute postexercise >10 mm Hg

If pressures at preexercise are >15 mm Hg, 1-minute postexercise >30 mm Hg, 5-minute postexercise >20 mm Hg, it will confirm a diagnosis of exertional compartment syndrome. Exertional compartment syndrome is becoming increasingly recognized as a source of pain in runners and cyclists. The onset of pain is gradual during exercise and ultimately restricts performance. Activity modification usually is effective. Refractory cases may require fasciotomy.Correct Answer: Preexercise >15 mm Hg, 1-minute postexercise >30 mm Hg, 5-minute postexercise >20 mm Hg

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2801. (252) Q7-364:

The most common adverse side effect of dietary supplementation with creatine in athletes is:

1) Friable tendons
3) Myopathy
2) Muscle cramping
5) Osteoporosis
4) Diabetes

Creatine has recently become a popular dietary supplement among athletes. The long-term effects of creatine are not known. However, it appears to cause muscle cramping and heat intolerance.Correct Answer: Muscle cramping

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2802. (253) Q7-365:

When testing an elbow for insufficiency of the medial collateral ligament, valgus stress should be applied with the elbow positioned at:

1) Full extension
3) 45Â° of flexion
2) 30Â° of flexion
5) 90Â° of flexion
4) 60Â° of flexion

When testing the medial collateral ligament of the elbow, it is important to apply valgus stress with the elbow flexed approximately 20Â° to 30Â° to disengage the olecranon from the olecranon fossa. It is always important to examine and compare the injured and uninjured side.Correct Answer: 30Â° of flexion

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2803. (543) Q7-759:

Internal impingement of the shoulder between the posterosuperior glenoid rim and the rotator cuff typically occurs with the arm in this position:

1) Abduction and internal rotation
3) Adduction and internal rotation
2) Adduction and external rotation
5) Abduction, external rotation, and flexion
4) Abduction, external rotation, and extension

Internal impingement of the shoulder occurs with the arm in the abducted, externally rotated, and extended position. This entity may be responsible for shoulder pain commonly occurring in overhead and throwing athletes. Initial treatment is focused on therapy that strengthens the anterior structures and scapular retractors and stretches the posterior structures. If nonoperative treatment fails, arthroscopic debridement, thermal capsular shrinkage, and humeral derotational osteotomy have all been used with varying degrees of success.Correct Answer: Abduction, external rotation, and extension

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2804. (544) Q7-760:

The following structure is most responsible for anterior stability of the glenohumeral joint with the arm in 45Â° of abduction:

1) Inferior glenohumeral ligament
3) Superior glenohumeral ligament
2) Middle glenohumeral ligament
5) Subscapularis muscle and tendon
4) Coracohumeral ligament

The middle glenohumeral ligament, although absent in up to one third of shoulders, is the largest contributor to anterior stability of the shoulder with the arm abducted 45Â°. The inferior glenohumeral ligament is the primary restraint to anterior instability with the arm abducted to 90Â° and externally rotated.Correct Answer: Middle glenohumeral ligament

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2805. (545) Q7-761:

The following structure is most responsible for resisting inferior translation of the glenohumeral joint with the arm at the side:

1) Inferior glenohumeral ligament
3) Coracoacromial ligament
2) Middle glenohumeral ligament
5) Subscapularis muscle and tendon
4) Coracohumeral ligament

The coracohumeral ligament coupled with the superior glenohumeral ligament provides the primary restraint to inferior translation of the glenohumeral joint with the arm at the side. The coracohumeral ligament also provides restraint to external rotation with the arm at the side.Correct Answer: Coracohumeral ligament

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2806. (546) Q7-762:

Maximal external rotation of the shoulder occurs during which phase of pitching:

1) Wind-up
3) Late cocking
2) Early cocking
5) Follow through
4) Deceleration

The pitching motion can be divided into 6 phases: wind-up, early cocking, late cocking, acceleration, deceleration, and follow through. Maximal external rotation at the shoulder occurs during late cocking.Correct Answer: Late cocking

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2807. (547) Q7-763:

A 45-year-old avid golfer complains of pain at the medial aspect of his elbow with participation. He denies radiation of the pain to his hand. Recommended treatment at this time should include:

1) Subcutaneous transposition of the ulnar nerve
3) Medial epicondylectomy
2) Submuscular transposition of the ulnar nerve
5) Eccentric stretching and strengthening of the elbow and forearm
4) Surgical release of the medial epicondyle

The most likely diagnosis in this patient is medial epicondylitis. Absence of symptoms radiating to the hand is contrary to the diagnosis of ulnar nerve entrapment. Initial treatment of stretching and strengthening is usually successful in these patients. In patients failing nonoperative treatment, surgical release and debridement of the inflamed tissues usually results in a satisfactory outcome.Correct Answer: Eccentric stretching and strengthening of the elbow and forearm

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2808. (548) Q7-765:

A 35-year-old avid rock climber complains of persistent anterior elbow pain with climbing, particularly when pulling himself up with his arms. The following muscle would most likely show increased activity on an electromyogram:

1) Long head of the biceps brachii
3) Brachialis
2) Short head of the biceps brachii
5) Flexor carpi ulnaris
4) Flexor carpi radialis

Brachialis tendonitis, or climberâs elbow, causes pain in the anterior elbow with the forearm in the pronated and flexed position. An electromyogram typically shows increased activity in the brachialis muscle.Correct Answer: Brachialis

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2809. (549) Q7-766:

A 16-year-old baseball pitcher complains of dominant-sided elbow pain when pitching. He has recently been removed from the pitching rotation because of "control" problems. Physical examination reveals pain when a supinated, flexed, and valgus stressed elbow is brought into progressive extension. The most likely diagnosis is:

1) Posterolateral rotatory instability
3) Ulnar nerve entrapment
2) Ulnar collateral ligament tear
5) Radial nerve entrapment
4) Posteromedial impingement

The process described is posteromedial impingement syndrome of the elbow. It typically presents as vague elbow pain with loss of control in pitchers. The valgus extension overload test typically elicits pain and sometimes crepitus. The pathological changes in posteromedial impingement syndrome start with chondromalacia on the medial aspect of the trochlear groove and may progress to osteophyte formation and loose bodies necessitating arthroscopic debridement.Correct Answer: Posteromedial impingement

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2810. (550) Q7-767:

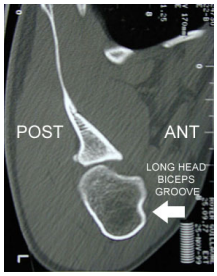

Figure 1

This slide is a computed tomogram of the shoulder of a 22-year-old rugby player. The most likely diagnosis is:

1) Anterior shoulder instability
3) Glenohumeral arthritis
2) Posterior shoulder instability
5) Subscapularis tear
4) Supraspinatus tear

The computed tomogram shows a posterior avulsion of the glenoid rim and an impaction fracture of the anterior aspect of the humeral head consisted with a prior posterior dislocation.Correct Answer: Posterior shoulder instability

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2811. (551) Q7-768:

Figure 1

This slide is a computed tomogram of the dominant shoulder of a 45-year-old male tennis player. The most likely diagnosis is:

1) Osteosarcoma
3) Anterior glenoid fracture
2) Synovial osteochondromatosis
5) Rotator cuff tear arthropathy
4) Synovial cell sarcoma

Synovial osteochondromatosis is a rare condition typically affecting middle-aged men. The computed tomogram demonstrates the osteocartilaginous nodules. Early in the disease, arthroscopic removal of loose bodies and synovectomy usually results in an acceptable outcome. In cases of progressive disease resulting in secondary shoulder arthrosis, shoulder arthroplasty may be required.Correct Answer: Synovial osteochondromatosis

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2812. (552) Q7-769:

Weight training that employs constant resistance throughout the arc of motion is referred to as:

1) Isometric
3) Isokinetic
2) Isotonic
5) Functional
4) Plyometric

Isotonic training employs a constant resistance throughout the arc of joint motionCorrect Answer: Isotonic

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2813. (553) Q7-770:

Weight training that employs a constant velocity and variable resistance is referred to as:

1) Isometric
3) Isokinetic
2) Isotonic
5) Functional
4) Plyometric

Isokinetic training employs constant velocity and variable resistance. Special equipment, such as a Cybex device (Cybex, Medway, Mass), is required for isokinetic training.Correct Answer: Isokinetic

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2814. (554) Q7-772:

During arthroscopic repair of a medial meniscal tear, the following structure is at greatest risk for damage:

1) Popliteal artery
3) Saphenous nerve
2) Popliteal vein
5) Popliteus tendon
4) Sural nerve

No matter what technique for arthroscopic medial meniscal repair is used, the saphenous nerve must be protected to avoid a painful neuroma postoperatively.Correct Answer: Saphenous nerve

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2815. (555) Q7-773:

During arthroscopic repair of a lateral meniscal tear, the following structure is at greatest risk for damage:

1) Popliteal artery
3) Peroneal nerve
2) Popliteal vein
5) Popliteus tendon
4) Sural nerve

When performing arthroscopic lateral meniscal repair, the peroneal nerve must be protected from insult.Correct Answer: Peroneal nerve

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2816. (556) Q7-774:

A 15-year-old male football player is discovered to have a reproducible painless pop with meniscal testing during a routine preparticipation physical examination. The patient states that he has never experienced any knee problems other than an occasional audible pop. His family physician orders a magnetic resonance image. It shows a discoid lateral meniscus without evidence of tearing. Recommended management should include:

1) No intervention
3) Abstinence from participation in any sport requiring pivoting or
2) Abstinence from participation in football only
5) Lateral meniscectomy
4) Excision of the central portion of the discoid meniscus

A discoid lateral meniscus can be complete, incomplete, or a Wrisberg variant. If asymptomatic, the patient can simply be observed without restriction. In patients with symptoms, the preferred treatment is excision of the central portion of the meniscus. In individuals with a discoid meniscus and a peripheral tear, repair of the tear is performed with excision of the central portion of the meniscus.Correct Answer: No intervention

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2817. (557) Q7-775:

When performing anterior cruciate ligament reconstruction using a bone-patellar tendon-bone autograft fixated with interference screws, up to how many degrees of divergence between the bone plug and the screw provides mechanically acceptable initial fixation strength on the femoral side?

1) 5Â°
3) 15Â°
2) 10Â°
5) 30Â°
4) 20Â°

Biomechanical studies have shown that up to 30Â° of divergence between the femoral bone plug and interference screw can be accepted without significantly compromising initial fixation strength.Correct Answer: 30Â°

2818. (558) Q7-777:

A 20-year-old male collegiate basketball player experiences a near syncopal episode during a particularly rigorous conditioning session. Appropriate management should include:

1) More intensive conditioning
3) Discontinuation of participation for 1 week
2) A short break, allowing the athlete to return when he feels ready
5) Urgent neurological evaluation
4) Urgent cardiac evaluation

A near syncopal episode in a young athlete may be a sign of an underlying life threatening condition. Most commonly, this is related to cardiac pathology, such as hypertrophic cardiomyopathy, idiopathic hypertrophic subaortic stenosis, or arrhythmias. These conditions require urgent medical attention as they are frequently life threatening. The athlete should not be allowed to participate until a complete medical (including cardiac) work up has been performed.Correct Answer: Urgent cardiac evaluation

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2819. (559) Q7-778:

On a cellular level, the nutritional supplement creatine has the following effect:

1) Increases water retention in cells
3) Causes hydrolysis of cells
2) Decreases water retention in cells
5) Causes decreased organelle production
4) Causes increased organelle production

Creatine is a popular nutritional supplement with athletes, and has a cellular effect of increasing water retention. This effect decreases the amount of free water available to the athlete and may result in cramping and dehydration. In season use of creatine is not recommended.Correct Answer: Increases water retention in cells

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2820. (560) Q7-779:

A 20-year-old male weight-lifter complains of progressive right shoulder pain when performing bench presses. He recalls no specific injury, and physical examination reveals mild swelling and tenderness in the right acromioclavicular joint. He is otherwise healthy with no other findings or complaints. The most likely diagnosis is:

1) Acromioclavicular joint dislocation
3) Arthrosis
2) Septic acromioclavicular joint
5) Subacromial impingement syndrome
4) Distal clavicular fracture

Distal clavicular osteolysis most commonly occurs in weight-lifters and is most symptomatic while performing bench presses. There is usually no history of trauma. Symptoms may be bilateral in up to 40% of patients. Treatment initially involves modification of training regimens and anti-inflammatory medications. Failing nonoperative interventions, distal clavicle excision is usually successful in alleviating symptoms.Correct Answer: Arthrosis

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2821. (561) Q7-780:

When comparing open distal clavicle resection with arthroscopic distal clavicle resection for osteolysis of the distal clavicle, arthroscopic techniques:

1) Less reliably resect the appropriate amount of distal clavicle
3) Have a higher complication rate
2) Less reliably provide pain relief
5) Allow quicker return to activity
4) Require a longer hospital stay

A study comparing arthroscopic and open techniques of distal clavicular resection in the treatment of osteolysis of the distal clavicle found no difference in the amount of bone resected or amount of pain relief obtained. The arthroscopic group had a shorter hospital stay, less complications, and returned to activity nearly twice as fast as the open group.Correct Answer: Allow quicker return to activity

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2822. (562) Q7-781:

Osteochondritis dissecans of the elbow most commonly occurs at this location:

1) Trochlea
3) Capitellum
2) Olecranon
5) Coronoid
4) Radial head

Osteochondritis dissecans of the elbow is most common in adolescent and pre-adolescent individuals who participate in sports that place an excessive amount of load on the radiocapitellar joint (e.g., baseball pitching, gymnastics). Factors involved in the development of this entity include repetitive microtrauma and a tenuous capitellar blood supply. Treatment may involve arthroscopic removal of loose bodies.Correct Answer: Capitellum

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2823. (563) Q7-782:

Administration of the "relocation test" to an abducted and externally rotated arm is considered positive for anterior instability if it:

1) Relieves pain
3) Increases pain
2) Relieves apprehension
5) Causes an anterior subluxation
4) Increases apprehension

The "relocation test" consists of placing a posteriorly directed force at the anterior aspect of the glenohumeral joint with the arm in abduction and external rotation. A positive result is recorded when the patient experiences some relief from feelings of apprehension. Relief of pain would suggest a diagnosis of posterosuperior glenoid impingement, which may occur with or without anterior glenohumeral instability.Correct Answer: Relieves apprehension

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2824. (564) Q7-783:

When examining an individual for suspected posterior instability of the glenohumeral joint, a posteriorly directed force is applied with the arm in this position:

1) Abduction, external rotation
3) Adduction, internal rotation
2) Abduction, internal rotation
5) Forward flexion, external rotation
4) Forward flexion, internal rotation

The appropriate position for testing posterior stability of the glenohumeral joint is 90Â° of forward flexion and internal rotation.Correct Answer: Forward flexion, internal rotation

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2825. (648) Q7-891:

Patellar tendinitis is associated with:

1) Pain at the insertion of the patellar tendon on the tibia
3) Lateral knee pain during downhill running
2) Pain at the insertion of the patellar tendon on the patella
5) "Giving way" of the knee during activity
4) Locking and popping of the knee during activity

Activities such as basketball, soccer, volleyball and track require repeated impact with the ground. This leads to micro-trauma, resulting in degeneration of the tendon and focal inflammation. Pain at the inferior pole of the patella is usually isolated with palpation along the tip of the kneecap.Correct Answer: Pain at the insertion of the patellar tendon on the patella

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2826. (649) Q7-892:

Patellar tendinitis:

1) Is most frequently diagnosed in patients over 40 years old.
3) Frequently has consistent radiographic changes that are pathognomonic to the condition.
2) Occurs at the superior pole of the patella.
5) Occurs at the insertion of the patellar tendon into the tibia.
4) Leads to fibrinoid necrosis and mucinous degeneration in the deep fibers of the tendon origin at the inferior pole of the patella.

The deep fibers of the patellar tendon are less elastic and more susceptible to stresses that create the micro-traumatic damage. This repetitive stress leads to the focal degeneration and chronic inflammation.Correct Answer: Leads to fibrinoid necrosis and mucinous degeneration in the deep fibers of the tendon origin at the inferior pole of the patella.

2827. (875) Q7-1141:

Septic arthritis of the knee within 4 weeks following anterior cruciate ligament (ACL) reconstruction using bone-patellar tendon-bone autograft should initially be treated with:

1) Culture-specific intravenous antibiotics
3) Culture-specific intravenous antibiotics and surgical irrigation with graft removal
2) Culture-specific intravenous antibiotics and surgical irrigation with graft retention
5) Culture-specific intravenous antibiotics, surgical irrigation with graft removal, and delayed revision reconstruction
4) Culture-specific intravenous antibiotics, surgical irrigation with graft removal, and immediate revision reconstruction

In a recent study that surveyed surgeons with expertise in ACL reconstruction surgery, 85% of surgeons selected culture-specific intravenous antibiotics and surgical irrigation of the joint with graft retention as initial treatment for the infected patellar tendon autograft. Sixty-four percent of surgeons chose this regimen as treatment for the infected allograft.

Correct Answer: Culture-specific intravenous antibiotics and surgical irrigation with graft retention

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2828. (876) Q7-1142:

In the setting of chronic anterior cruciate ligament (ACL) deficiency, which of the following meniscal tear patterns is most common:

1) Peripheral posterior horn tears of the medial meniscus
3) Peripheral anterior horn tears of the medial meniscus
2) Peripheral posterior horn tears of the lateral meniscus
5) Central posterior horn tears of the medial meniscus
4) Peripheral anterior horn tears of the lateral meniscus

Medial meniscal tears account for approximately 45% of acute tears and 70% of chronic tears in patients with ACL insufficiency. Peripheral posterior horn tears of the medial meniscus are the most common type of tear associated with chronic ACL deficiency.

Correct Answer: Peripheral posterior horn tears of the medial meniscus

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2829. (877) Q7-1143:

All of the following are reported complications following the surgical treatment of medial epicondylitis except:

1) Ulnar neuritis
3) Permanent flexor mass weakness
2) Injury to the medial antebrachial cutaneous nerve
5) Injury to the ulnar collateral ligament (UCL)
4) Injury to the posterior interosseous nerve (PIN)

The potential complications associated with the surgical treatment of medial tendon injuries primarily involve the structures surrounding the medial epicondyle. The most frequent complications involve the ulnar nerve. Careful dissection through the subcutaneous tissues must be performed so that the medial antebrachial cutaneous nerve can be isolated and protected. Extensive release of the flexor-pronator mass can lead to permanent flexor weakness, as well as detachment of the UCL from the medial epicondyle. The PIN is located on the lateral side of the elbow and its injury is not a reported complication associated with medial epicondylar debridement.

Correct Answer: Injury to the posterior interosseous nerve (PIN)

2830. (878) Q7-1144:

In valgus extension overload of the elbow, impingement occurs between which of the following structures:

1) Ulnar nerve and ulnar collateral ligament
3) Posterolateral olecranon process and radial head
2) Posteromedial olecranon process and posteromedial olecranon fossa
5) Posteromedial olecranon process and ulnar nerve
4) Coronoid process and radial head

Valgus extension overload is unique to the throwerâs elbow. Valgus extension overload of the elbow involves attenuation and creep in the ulnar collateral ligament that transfers compressive forces to the lateral compartment of the elbow at the radiocapitellar joint. In the posterior elbow compartment, the valgus moment creates contact between the posteromedial aspect of the olecranon process and the posteromedial olecranon fossa.

Correct Answer: Posteromedial olecranon process and posteromedial olecranon fossa

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2831. (879) Q7-1145:

Anteroposterior displacement of the acromion on the clavicle is most strongly resisted by which of the following structures:

1) The conoid ligament
3) The osseous articulation of the acromion on the clavicle
2) The acromioclavicular ligaments
5) The trapezoid ligament
4) The acromioclavicular meniscus

During high loads, the coracoclavicular ligaments (conoid and trapezoid ligament) resist vertical and compressive loads across the acromioclavicular joint. The conoid ligament is the strongest ligament resisting downward movement of the scapula relative to the clavicle. The acromioclavicular ligaments maintain alignment of the joint in the axial plane.

Correct Answer: The acromioclavicular ligaments

2832. (880) Q7-1146:

Causes of distal clavicular osteolysis include all of the following except:

1) Rheumatoid arthrosis
3) Sarcoidosis
2) Diabetes mellitus
5) Repetitive microtrauma
4) Hyperparathyroidism

Osteolysis of the distal clavicle has been associated with various conditions. Among the most common causes is repetitive microtrauma from activities such as weight lifting, gymnastics, and swimming. Other causes include rheumatoid arthrosis and hyperparathyroidism. The diagnosis of sarcoidosis should be considered in bilateral cases. Diabetes mellitus has not been associated with this condition.

Correct Answer: Diabetes mellitus

2833. (882) Q7-1148:

Which of the following describes the correct relationship between the suprascapular nerve and the suprascapular vessels as they pass through the suprascapular notch:

1) The suprascapular nerve, artery, and vein all pass below the transverse scapular ligament.
3) The suprascapular nerve passes superficially to the transverse scapular ligament while the artery and vein pass deep to it.
2) The suprascapular nerve, artery, and vein all pass superficially to the transverse scapular ligament.
5) The suprascapular nerve passes deep to the transverse scapular ligament while the suprascapular artery and vein pass above it.
4) The suprascapular nerve and artery pass deep to the transverse scapular ligament while the suprascapular vein passes superficially to it.

The suprascapular nerve is a branch of the upper trunk of the brachial plexus at Erbâs point. The suprascapular nerve receives branches primarily from the fifth cervical nerve root. The nerve follows the omohyoid muscle laterally and passes beneath the anterior border of the trapezius muscle to the upper border of the scapula where it joins the suprascapular artery. It passes through the suprascapular notch deep to the transverse scapular ligament. The artery and vein pass superficial to the ligament and join the nerve distally in the suprascapular fossa. After innervating the supraspinatus muscle, the nerve passes around the lateral free margin of the scapular spine (spinoglenoid notch) to innervate the infraspinatus muscle.

Correct Answer: The suprascapular nerve passes deep to the transverse scapular ligament while the suprascapular artery and vein pass above it.

2834. (883) Q7-1149:

All of the following factors have been used to explain why exertional compartment syndrome is more common in the lower leg when compared to the upper arm except:

1) Muscle straining that occurs in the lower leg seldom occurs in the upper arm.
3) The brachialis fascia is less taut than the crural fascia.
2) Muscle compartments of the upper arm blend anatomically with the shoulder girdle making it less likely that bleeding would be confined to the compartment of the upper extremity.
5) The pulse pressure of the lower extremity is greater than that of the upper extremity.
4) The brachialis fascia yields more to increased intracompartmental pressure as compared to the crural fascia.

There are several reasons that have been offered as to why upper arm compartment syndromes are so rare. First, the brachialis fascia is less taut and contains less rigid ligaments than the fascia in the lower leg. Second, the brachialis fascia yields more to increased intracompartmental pressure as compared to the fascia of the lower leg. Third, the muscle compartments of the upper arm blend anatomically with the shoulder girdle making it less likely that bleeding would be confined enough to develop into a compartment syndrome. Finally, muscle stresses that occur in the lower leg during events such as prolonged march seldom occur in the arm.

Correct Answer: The pulse pressure of the lower extremity is greater than that of the upper extremity.

2835. (1024) Q7-1331:

During arthroscopic repair of the lateral meniscus using an "outside-in technique," the most important way to prevent damage to the peroneal nerve is to:

1) Fully extend the leg during the repair
3) Make a large incision to identify the nerve
2) Keep the knee flexed at least to 90Â° while performing the repair
5) Repair of the lateral meniscus should be done only with an inside-out technique to prevent injury to the peroneal nerve
4) Repair of the lateral meniscus should be done only with intra-articular arrows to prevent injury to the peroneal nerve

The most important consideration in arthroscopic repair of the lateral meniscus is to avoid injuring the peroneal nerve. This is done best by using an outside-in technique and flexing the knee to 90Â° while passing the needles. With flexion of the knee, the peroneal nerve falls posterior to the joint line. It is important to remember to keep the needles anterior to the biceps.Correct Answer: Keep the knee flexed at least to 90Â° while performing the repair

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2836. (1025) Q7-1332:

A 20-year old female collegiate swimmer has suffered from pain in her right shoulder and inability to compete for the last 9 months. She has been diagnosed with multidirectional instability. Physical therapy for 7 months has failed, and she wishes to swim competitively again. Assuming the diagnosis is correct, the next step should be:

1) Bankhart capsulolabral repair
3) Bristow procedure (coracoid process transfer)
2) Posterior capsular shift
5) Superior capsular shift
4) Inferior capsular shift

Initial treatment of multidirectional instability is with rehabilitation. These patients, who have loose capsules, often rely on dynamic stabilizing mechanisms rather than tight ligamentous constraint. If surgery is to be performed, the procedure of choice is the inferior capsular shift, originally described by Neer. It reduces the volume of the glenohumeral joint inferiorly, anteriorly, and posteriorly by equalizing capsular tightness on all three sides.Correct Answer: Inferior capsular shift

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2837. (1026) Q7-1333:

How is an anterior drawer test performed to evaluate the competence of the anterior talofibular ligament in a patient with a possible ankle sprain:

1) Knee bent, ankle dorsiflexed
3) Knee bent, ankle plantar flexed
2) Knee bent, ankle neutral
5) Knee extended ankle plantar flexed
4) Knee extended ankle neutral

The anterior drawer test should be performed with the patient sitting, the knee bent, and the ankle plantar flexed in a position of comfort. Flexing the knee relaxes the gastrocnemius. Plantar flexion relaxes the peroneals. The tibia is braced with one hand and the hindfoot is gently brought forward. The amount of anterior translation is compared between feet.Correct Answer: Knee bent, ankle plantar flexed

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2838. (1027) Q7-1334:

A 13-year-old female competitive gymnast has had pain in her lumbar spine and anterior thighs for 9 weeks. It has become significant enough to limit her activities. Radiographs of her lumbar and thoracic spine are normal and iliac crests show that she is not skeletally mature. Physical examination is essentially normal with no long tract or nerve tension signs present. What is the next appropriate step in a diagnostic work up:

1) Magnetic resonance image (MRI) of lumbar spine
3) CT of thoracic spine
2) Computed tomography (CT) scan of lumbar spine
5) Technetium bone scanning
4) MRI of thoracic spine

This athlete most likely has spondylolysis of the lumbar spine. Repetitive hyperextension of the lumbar spine with stress concentrated at the pars interarticularis can lead to stress fractures especially in the fourth or fifth lumbar vertebrae. Spondylolysis is the most common bony injury in the athlete's spine. The most sensitive way to delineate this injury is with technetium bone scanning. CT and MRI are not as helpful in the diagnosis or treatment of spondylolysis, unless the patient has frank radicular symptoms.Correct Answer: Technetium bone scanning

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2839. (1028) Q7-1335:

The posterior cruciate ligament sustains from 85% to 100% of the load of a posterior directed force at 90Âº of flexion. Which fibers of the ligament are responsible for this:

1) Anterolateral bundle
3) Posteromedial bundle
2) Anteromedial bundle
5) Anterolateral and posteromedial equally
4) Posterolateral bundle

The posterior cruciate ligament is the primary restraint to posterior tibial translation, sustaining the majority of force across the knee at 90Âº of flexion. The PCL has two functional components, an anterolateral portion, and a posteromedial portion. These two "bundles" are named according to their insertions. The anterolateral bundle is tight in flexion and is biomechanically superior to the posteromedial bundle. For this reason, "one bundle techniques" attempt to reproduce the anterolateral bundle.Correct Answer: Anterolateral bundle

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2840. (1029) Q7-1336:

A fourteen-year-old little league pitcher has lateral elbow pain that is worsened by throwing. Plain radiographs demonstrate fragmentation of the capitellum with no evidence of a loose body. A presumptive diagnosis of osteochondritis dissecans of the capitellum has been made. He has undergone rest, followed by physical therapy over the past three months. Now range of motion is from 30 to 120, and pain is present when attempting to throw. The next appropriate step is:

1) Extension Dyna-Splint at night time
3) Rest until skeletal maturity is reached, and further re-evaluation
2) Aggressive range of motion with physical therapy and iontophoresis
5) Open reduction and internal fixation of capitellar fracture
4) Arthroscopy of the elbow with debridement of defect

This patient has osteochondritits dissecans of the capitellum from pitching. OCD of the capitellum differs from Panner's disease, which is a osteochondrosis of the capitellum which occurs at a younger age (7-12) and is less symptomatic. Initial treatment of osteochondritis dissecans of the capitellum is rest and occasional splinting. Arthroscopy is indicated for both detached lesions and those who have failed conservative therapy. The entire joint should be a assessed, loose fragments removed and the subchondral bone of the defect is debrieded to a healthy vascular bed.Correct Answer: Arthroscopy of the elbow with debridement of defect

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2841. (1030) Q7-1337:

The primary stabilizer of the elbow to valgus stress is:

1) The posterior bundle of the medial collateral ligament
3) The transverse bundle of the medial collateral ligament
2) The anterior bundle of the medial collateral ligament
5) The superior bundle of the medial collateral ligament
4) The inferior bundle of the medial collateral ligament

The medial collateral ligament complex of the elbow consists of three parts: the anterior, posterior, and transverse segments or bundles. The anterior bundle is the most distinct portion. The posterior bundle/segment is a thickening of the capsule and notable only at 90 degrees of flexion. The transverse component or ligament of Cooper appears to contribute little to elbow stability. There are no inferior or superior bundles.Correct Answer: The anterior bundle of the medial collateral ligament

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2842. (1031) Q7-1338:

A collegiate football player sustains a direct blow to his anterior shoulder. Physical examination reveals ecchymosis over the anterior shoulder and painful range of motion. Radiographs include an anteroposterior, scapular Y and an axillary lateral. The radiographs show the humeral head to be located with an isolated fracture at the base of the coracoid process. Treatment should consist of:

1) Screw fixation of the coracoid base
3) Sling immobilization with gradual progressive range of motion
2) Airplane type splinting at 90Âº of abduction for 6 weeks, followed by progressive range of motion
5) Costoclavicular ligament reconstruction
4) Costoclavicular screw fixation

Acute isolated fracture of the coracoid base is almost invariably treated conservatively with the expectation of a good result. If the acromioclavicular joint is sound, the basal fracture is splinted by the costoclavicular ligaments, and displacement is minimal. Treatment with a sling for comfort is sufficient. Pendulum exercises are encouraged. Overhead elevation is restricted for 4-6 weeks to allow healing. Return to sports can occur after healing of the fracture and return to full, painless range of motion. This usually requires 6 to 8 weeks.Correct Answer: Sling immobilization with gradual progressive range of motion

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2843. (1032) Q7-1339:

The infraspinatus is strengthened best by which exercise:

1) External rotation at 70Âº of elevation
3) External rotation at 0Âº of elevation
2) Internal rotation at 70Âº of elevation
5) Scapular elevation with internal humeral rotation
4) Internal rotation at 0Âº of elevation

The infraspinatus is primarily responsible for external rotation, humeral head depression, and posterior approximation at lower elevations, whereas the teres minor functions at higher elevations. Therefore, external rotation with the arm near the side of the body is optimal for strengthening the infraspinatus. External rotation at approximately 70Âº is more appropriate for strengthening the teres minor.Correct Answer: External rotation at 0Âº of elevation

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2844. (1033) Q7-1340:

When comparing male and female competitive athletes, what can be said regarding anterior cruciate ligament injuries:

1) Females have a lower relative risk for anterior cruciate ligament (ACL) injuries.
3) Males and female competitive athletes have equal risk for injuries.
2) Females have an increased relative risk for ACL injuries.
5) There have been no studies examining this association as it may be construed as sexist.
4) A comparison is difficult to make due to the different sports played by each sex.

It has been shown that competitive female athletes have an increased relative risk for anterior cruciate ligament injury in college sports as well as during military training. Possible causative factors have been suggested (body movement, muscular strength, joint laxity, limb alignment, notch dimensions, effects of estrogen), but none have been proven as of yet.Correct Answer: Females have an increased relative risk for ACL injuries.

2845. (1034) Q7-1341:

The most common location for a meniscal cyst is:

1) Middle third of the lateral meniscus
3) Posterior horn of the lateral meniscus
2) Middle third of the medial meniscus
5) Anterior horn of the medial meniscus
4) Anterior horn of the lateral meniscus

Mensical cysts are rather uncommon and occur most frequently in the middle third of the lateral meniscus. They are less common in the medial meniscus, where they tend to occur in the posterior horn. They are often associated with horizontal, cleavage type tears of the meniscus. Lateral cysts tend to be smaller and are localized to the joint line, where medial cysts can be large and may dissect through the capsule.Correct Answer: Middle third of the lateral meniscus

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2846. (1035) Q7-1342:

If a distal biceps tendon avulsion is not repaired or reconstructed, what is the likely result:

1) Loss of 90% of flexion an 20 % of supination strength
3) 20% loss of flexion strength and no loss of supination strength
2) No loss of flexion strength and 40% loss of supination strength
5) 20% loss of flexion and 40% loss of supination strength
4) No significant clinical deficit will occur

Untreated distal biceps rupture results in a loss of about 20% flexion and 40% supination strength.Correct Answer: 20% loss of flexion and 40% loss of supination strength

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2847. (1036) Q7-1343:

The best clinical test for diagnosis of an anterior cruciate ligament (ACL) rupture is:

1) Anterior drawer
3) Losee
2) Pivot shift
5) Single leg hop
4) Lachman

The Lachman test provides the best predictive value of all clinical tests for diagnosis of an anterior cruciate ligament rupture. The diagnosis of a complete ACL rupture can be reliably made clinically without the added expense of a preoperative magnetic resonance image.Correct Answer: Lachman

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2848. (1037) Q7-1344:

The reason a patient with an acute rupture of the anterior cruciate ligament will usually have a hemarthrosis is due to disruption of what main blood supply to the ligament:

1) Lateral superior geniculate artery
3) Middle geniculate artery
2) Medial superior geniculate artery
5) Lateral inferior geniculate artery
4) Medial inferior geniculate artery

The major blood supply to the anterior cruciate ligament arises from the ligamentous branches of the middle genicular artery, with minor contribution from the terminal branches of the medial and lateral inferior genicular arteries. The ACL is covered in a synovial fold that is richly supplied by the middle geniculate artery.Correct Answer: Middle geniculate artery

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2849. (1038) Q7-1345:

A football player is down and unconscious after making a tackle. He is found lying supine. What initial management should be undertaken on the playing field:

1) Remove helmet, place cervical collar, check for breathing, place on spine board
3) Remove helmet and shoulder pads, hold cervical traction and place on spine board
2) Remove chinstrap only, check for breathing, place on spine board
5) Place on spine board immediately, check breathing once secured, with helmet on and chinstrap buckled, if airway problems noted, remove under in-line traction and assess further
4) Check breathing with helmet and chinstrap buckled, if airway problems are noted, remove facemask only, place on spine board

Prevention of further injury is the single most important objective in this patient. While maintaining immobilization of the head and neck check for airway, breathing and pulses (ABC), followed by level of consciousness. The chin strap and helmet fastened will support the head and neck, and keep it aligned with the body, thereby reducing the risk of spinal cord injury associated with unstable fractures and dislocations. The face mask must be removed from the helmet before rescue breathing can ensue.Correct Answer: Check breathing with helmet and chinstrap buckled, if airway problems are noted, remove facemask only, place on spine board

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2850. (1039) Q7-1346:

A 30-year-old competitive body builder felt a severe pain in his proximal humerus after performing a bench press exercise. He has significant ecchymoses over the anterior aspect of his proximal arm and axilla. There is significant limitation of motion due to pain, with pain to palpation over the insertion of the pectoralis major and the axilla. A magnetic resonance image showed more than 80% avulsion of the pectoralis major from the humerus. What treatment should this patient undergo:

1) Subscapularis transfer
3) Wait until swelling decreases and range of motion returns to normal, then perform a primary repair
2) Primary repair of the tendon to bone through drill holes or with anchors
5) Semitendinosis augmentation with repair of the pectoralis tendon through drill holes once swelling and motion are normal
4) No treatment is necessary, the patient will have functional results with rehabilitation

A complete rupture of the pectoralis insertion demands early surgical treatment in the active athlete. Results of late repair are inferior when compared with primary repair. The tendon is either sutured to bone or anchors are placed to augment repair. Results of those with surgery within one week of injury have been shown to be superior compared to those with delayed surgery or no surgery.Correct Answer: Primary repair of the tendon to bone through drill holes or with anchors

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2851. (1040) Q7-1347:

When making an anteromedial portal for ankle arthroscopy, which structure is most "at risk" for injury:

1) The superficial peroneal nerve
3) The extensor hallucis longus
2) The dorsalis pedis artery
5) The saphenous vein
4) The posterior tibial nerve

The anteromedial portal is adjacent to the saphenous vein, and injury may occur if care is not taken when creating the portal. A nick in the skin is made and then blunt hemostats are used to spread in line with the neurovascular structures to decrease the likelihood of injury. The anterolateral portal is associated with injury to the superficial peroneal nerve. The anterior-central portal is associated with injury to the dorsalis pedis artery.Correct Answer: The saphenous vein

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2852. (1041) Q7-1348:

Fibrinous degradation in which muscle insertion most commonly characterizes lateral epicondylitis or tennis elbow:

1) Extensor carpi radialis brevis
3) Extensor carpi ulnaris
2) Extensor carpi radialis longus
5) Extensor digitourm longus complex
4) Brachioradialis

Degeneration at the extensor muscle group insertion to the lateral epicondyle, primarily the extensor carpi radialis brevis, can be a result of overuse or poor technique in racket sports. Tenderness to palpation at the insertion of the extensor carpi radialis brevis and pain with resisted wrist extension are common findings.Correct Answer: Extensor carpi radialis brevis

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2853. (1042) Q7-1349:

A patient underwent bone-patellar-bone anterior cruciate ligament reconstruction. Postoperative radiographs show the femoral tunnel has been placed too far anteriorly. What is the most likely clinical result of anterior placement of the femoral tunnel:

1) Limited extension
3) Anterior knee pain
2) Anterior instability
5) Posterior instability
4) Limited flexion

A femoral tunnel that has been placed too anterior will limit extension. Numerous studies have shown the most common technical mistake intraoperatively is placement of either the tibial or the femoral tunnel, or both, too far anteriorly. Either of these aberrant placements may cause impingement of the graft and thus promote formation of a large lump of fibrous tissue, known as a Cyclops lesion. This lesion forms anterior to the graft, potentially blocking extension of the knee.Correct Answer: Limited extension

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2854. (1043) Q7-1350:

During a wrist arthroscopy in a basketball player who has ulnar-sided wrist pain, the articular disk of the triangular fibrocartilage complex is observed. A probe is inserted and the disk is free floating without tension, (a negative "trampoline test"). What does this signify:

1) Flexor carpi ulnaris subluxation
3) Scapholunate instability
2) Distal radioulnar joint disruption
5) Ulnar abutment syndrome
4) Tear in either the central or peripheral portion of the TFCC

A probe should be used to test the integrity of the articular disc of the TFCC. This disk should be fairly taught, similar to a trampoline. When the articular disk is floppy and floating without tension, a tear in either the central or peripheral portion must be suspected.Correct Answer: Tear in either the central or peripheral portion of the TFCC

2855. (1044) Q7-1351:

A football player has suffered a concussion. It is his first such injury. He suffered loss of consciousness for about 30 seconds and was confused after for 45 minutes. He is now fully asymptomatic at the end of the football game (1 hour after injury). When should he return to play:

1) The next day
3) In 1 week
2) After one month if computed tomography (CT) scan of the brain is negative
5) The next day, if CT scan of the brain is negative
4) He should sit out the rest of the season.

This patient has suffered a grade 2, or moderate concussion. These patients may return to play after one week if asymptomatic.

- Grade 1: No LOC, posttraumatic amnesia <30 minutes; return to play when symptoms resolve
- Grade 2: LOC <5 minutes or posttraumatic amnesia >30 minutes; return to play after one week if asymptomatic.
- Grade 3: LOC >5 minutes, or posttraumatic amnesia >24 hours; minimum delay of 1 month, then may return if asymptomatic.

Correct Answer: In 1 week

2856. (1045) Q7-1352:

A collegiate tennis player has undergone surgery for recalcitrant tennis elbow (lateral epicondylitis). He now complains of clicking, catching, and "slipping out of joint" of the elbow. Examination reveals a positive "pivot shift" test of the elbow with normal motion. Radiograph examination is normal. The primary stabilizer of the elbow that is damaged in this patient giving rise to his symptoms of posterolateral rotatory instability is:

1) Lateral ulnar collateral ligament
3) Medial collateral
2) Annular ligament
5) Common extensor muscle attachment to the lateral epicondyle
4) Posterior capsule of the elbow

This patient has incompetence of the lateral ligamentous constraint to the elbow. The most common causes for this injury are previous dislocations and iatrogenic approaches to the lateral elbow. Up to 25% of cases of failed tennis elbow surgery are associated with lateral ligamentous insufficiency. The lateral ulnar collateral ligament has been shown to be the primary restraint to posterolateral instability of the elbow.Correct Answer: Lateral ulnar collateral ligament

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2857. (1046) Q7-1353:

A 56-year-old competitive triathelete fell off his bicycle and sustained a traumatic anterior shoulder dislocation. The dislocation was reduced in the emergency room. No associated fractures were noted. A magnetic resonance image examination would be judicious in this patient to:

1) Assess the capsuloligamentous integrity of the shoulder
3) Assess the integrity of the articular cartilage
2) Assess for glenoid labrum tears
5) Evaluate the bone for occult fractures
4) Assess the integrity of the rotator cuff

Rotator cuff tears may accompany anterior and inferior glenohumeral dislocations. The frequency of this complication increases with age. In patients older than 40 years incidence exceeds 30%; in patients older than 60 years, the incidence exceeds 80%. Shoulder ultrasound, arthrography or MRI is indicated in patients over 40 years of age, with a shoulder dislocation. Prompt repair of these lesions is usually indicated.Correct Answer: Assess the integrity of the rotator cuff

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2858. (1047) Q7-1354:

What is the mechanism of injury that leads to the clinical diagnosis of "turf toe":

1) Forced lateral stress
3) Forced plantarflexion
2) Forced medial stress
5) Forced dorsiflexion
4) Forced compression of the first MTP

Turf toe is a sprain of the plantar capsuloligamentous complex of the first MTP joint that is associated with play on artificial playing surfaces. The classic mechanism of injury is a forced hyperextension injury to the 1st MTP joint. Dorsiflexion in excess of a normal range of motion can lead to varying degrees of soft tissue capsular disruption or injury to the articular cartilage and subchondral bone. Factors that predispose a player to injury are increasing age, number of years in professional football, pes planus, and decreased range of motion in the ankle and/or 1st MTP joint.Correct Answer: Forced dorsiflexion

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2859. (1048) Q7-1355:

The gold standard for evaluation of chronic compartment syndrome in the athlete is:

1) Clinical examination
3) Resting compartment measurements
2) Electromyogram post exercise
5) Elevated compartment pressures during exercise
4) Elevated post exercises compartment pressures

The gold standard for diagnosing chronic or exertional compartment syndrome in the athlete is demonstration of elevated compartment pressures post exercise. Normal increases in compartment pressures with exercise will decrease to normal within 2 minutes of exercise cessation. Pedowitz et al has developed a criteria for diagnosis with any of the following: pre-exercise pressure > 15 mm Hg, 1 minute post exercise pressure > 30 mm Hg, or 5 min post exercise of > 20 mm Hg.Correct Answer: Elevated post exercises compartment pressures

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2860. (1444) Q7-1821:

Internal impingement of the shoulder between the posterosuperior glenoid rim and the rotator cuff occurs in which phase of throwing:

1) Wind-up
3) Late cocking
2) Early cocking
5) Follow-through
4) Acceleration

Internal impingement of the shoulder occurs with the arm in the abducted, externally rotated, and extended position that corresponds with the late cocking phase of throwing. Internal impingement is responsible for shoulder pain commonly occurring in overhead and throwing athletes. Initial treatment is focused on therapy that strengthens the anterior structures, stretches the posterior structures, and controls the scapular position in space. If nonoperative treatment fails, arthroscopic debridement, thermal capsular shrinkage, and humeral derotational osteotomy have been used with varying degrees of success.Correct Answer: Late cocking

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2861. (1445) Q7-1822:

When comparing open distal clavicle resection with arthroscopic distal clavicle resection for osteolysis of the distal clavicle, arthroscopic techniques:

1) Less reliably resect the appropriate amount of distal clavicle
3) Have a higher complication rate
2) Less reliably provide pain relief
5) Have no different outcomes
4) Result in a longer delay in return to sports

A study comparing arthroscopic and open techniques of distal clavicular resection in the treatment of osteolysis of the distal clavicle found no difference in the amount of bone resected or amount of pain relief obtained. The arthroscopic group had a shorter hospital stay and less complications, and returned to activity nearly twice as fast as the open technique group.Correct Answer: Have no different outcomes

2862. (1446) Q7-1823:

Slide 1

A magnetic resonance image (MRI) of the dominant elbow of a 19-year-old minor league baseball pitcher is presented (Slide). He has been unable to pitch for the past 6 weeks secondary to pain. The recommended treatment includes:

1) Physical therapy for triceps strengthening
3) Ulnar nerve transpostion
2) Physical therapy for pronator strengthening
5) Ulnar collateral ligament reconstruction
4) Radial collateral ligament reconstruction

The MRI shows a disruption of the humeral attachment of the ulnar collateral ligament. The ulnar collateral ligament of the elbow is the most frequently observed ligamentous elbow injury in baseball pitchers. Recommended treatment in the throwing athlete is reconstruction of the ulnar collateral ligament with an autogenous palmaris longus graft.Correct Answer: Ulnar collateral ligament reconstruction

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2863. (1447) Q7-1824:

Following acute lateral traumatic patellar dislocation, the surgical procedure that most closely reconstructs the injured structure is:

1) Arthroscopic lateral release
3) Medial patellofemoral ligament reconstruction
2) Vastus medialis obliquus advancement
5) Tibial tubercle transfer
4) Medial patellotibial ligament reconstruction

The medial patellofemoral ligament is the primary restraint to lateral subluxation of the patella. The other structures contribute less substantially to patellofemoral stability. In the majority of cases of acute traumatic patellar dislocation, the medial patellofemoral ligament is disrupted.Correct Answer: Medial patellofemoral ligament reconstruction

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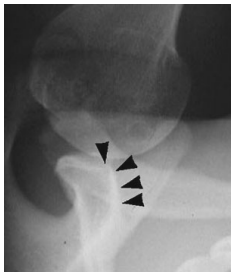
2864. (1448) Q7-1827:

A 22-year-old male tennis player has dominant side shoulder pain when serving and hitting overheads. Despite a prolonged course of physiotherapy, he is unable to return to tennis because of shoulder pain. His treating physician recommends arthroscopy of his shoulder with debridement of associated lesions. What is the likelihood that he will be playing tennis at his preinjury level of competition at 1 year following surgery:

1) 10%
3) 50%
2) 30%
5) 90%
4) 75%

This patient has internal impingement of the shoulder, presumably with associated labral and rotator cuff lesions. Sonnery-Cottet and colleagues reported results of 28 tennis players with internal impingement treated with arthroscopic debridement of associated lesions. Although 22 of the 28 tennis players were able to return to tennis following surgery, only 14 of the players were able to return to their preinjury level of competition.Correct Answer: 50%

2865. (1449) Q7-1829:



Slide 1

A glenoid profile radiograph (Slide) of a 21-year-old male rugby player with multiple traumatic anterior shoulder dislocations is presented. Which of the following is the preferred treatment:

1) Sling for a period of 6 weeks
3) Capsular shift
2) Physiotherapy emphasizing strengthening of dynamic shoulder stabilizers
5) Bony augmentation procedure(iliac crest)
4) Bankart reconstruction

The radiograph demonstrates anterior glenoid rim insufficiency, which is a risk factor for failure of soft tissue reconstructions especially in contact athletes. The arrows on the figure represent the anterior border of the glenoid rim. A coracoid transfer procedure to reconstruct the anterior bony deficiency maximizes the possibility for successful restoration of shoulder stability.Correct Answer: Bony augmentation procedure(iliac crest)

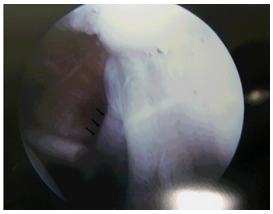
2866. (1450) Q7-1830:

Which of the following statements is true regarding humeral retroversion in a throwerâs dominant shoulder:

1) Humeral retroversion in a throwerâs dominant shoulder is the same as in the nondominant shoulder.
3) Humeral retroversion in a throwerâs dominant shoulder is greater than humeral retroversion in the nondominant shoulder.
2) Humeral retroversion in a throwerâs dominant shoulder is less than humeral retroversion in the nondominant shoulder.
5) Humeral retroversion in a throwerâs dominant shoulder is less than humeral retroversion in a nonthrowerâs dominant shoulder.
4) Humeral retroversion in a throwerâs dominant shoulder is the same humeral retroversion in a nonthrowerâs dominant shoulder.

Throwers have increased humeral retroversion in their dominant shoulder compared to their contralateral shoulder and to the dominant shoulder of nonthrowers. This represents an adaptive change that probably occurs through the physis (a pathologic expression of this adaptation probably exists in the form of proximal humeral epiphysealysis or little leaguerâs shoulder) and has two benefits. First, humeral retroversion allows increased external rotation during throwing activities. Second, humeral retroversion acts as a protective mechanism against impingement of the greater tuberosity on the posterosuperior glenoid rim during throwing.Correct Answer: Humeral retroversion in a throwerâs dominant shoulder is greater than humeral retroversion in the nondominant shoulder.

2867. (1451) Q7-1831:



Slide 1

An arthroscopic photo (Slide) looking from the posterior portal is presented. The arrows point to which structure:

1) Superior glenohumeral ligament
3) Middle glenohumeral ligament
2) Inferior glenohumeral ligament
5) Coracoacromial ligament
4) Coracohumeral ligament

The middle glenohumeral ligament is readily visualized crossing the subscapularis from the posterior arthroscopic portal. The middle glenohumeral ligament may be absent in as many as 30% of shoulders.Correct Answer: Middle glenohumeral ligament

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2868. (1452) Q7-1832:

When performing a Latarjet coracoid transfer for anterior shoulder instability with bony anterior glenoid rim insufficiency, glenoid surface of the coracoid transfer must be positioned.

1) Flush with the glenoid rim
3) 10 mm medial to the glenoid rim
2) 5 mm medial to the glenoid rim
5) 10 mm lateral to the glenoid rim
4) 5 mm lateral to the glenoid rim

Allain and colleagues have clearly demonstrated that a coracoid transfer overhanging laterally to the glenoid rim is associated with the development of arthritis. One of the functions of the coracoid transfer is to increase the anteroposterior diameter of the glenoid, not to serve as a âbone block.âCorrect Answer: Flush with the glenoid rim

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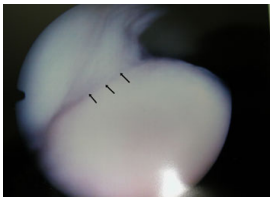
2869. (1453) Q7-1833:



Slide 1

An arthroscopic photo (Slide) during shoulder arthroscopy looking from the posterior portal is presented. The arrows point to which structure:

1) Biceps tendon
3) Supraspinatus tendon
2) Subscapularis tendon
5) Inferior glenohumeral ligament
4) Teres minor tendon

The insertion of the supraspinatus tendon is readily visible through the posterior arthroscopic portal.Correct Answer: Supraspinatus tendon

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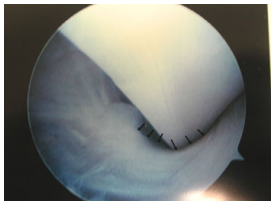
2870. (1454) Q7-1835:



Slide 1

An arthroscopic photo (Slide) of the shoulder looking from the posterior portal is presented. The large white structure at the top of the figure is the biceps tendon. The arrows point to which structure:

1) Middle glenohumeral ligament
3) Superior glenoid labrum
2) Inferior glenohumeral ligament
5) Ligamentous pulley
4) Anterior glenoid labrum

The arrows point to the ligamentous pulley. The ligamentous pulley is responsible for stabilizing the biceps within the bicipital groove of the humerus. An intact ligamentous pulley precludes arthroscopic diagnosis of superior subscapularis tendon tears.Correct Answer: Ligamentous pulley

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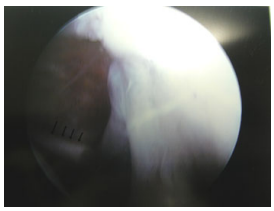
2871. (1455) Q7-1836:



Slide 1

An arthroscopic photo (Slide) looking from the posterior portal is presented. The arrows point to which structure:

1) Biceps tendon
3) Supraspinatus tendon
2) Subscapularis tendon
5) Inferior glenohumeral ligament
4) Middle glenohumeral ligament

The identified structure is the subscapularis tendon, which is readily visible during shoulder arthroscopy. The middle glenohumeral ligament crosses the superior border of the subscapularis tendon.Correct Answer: Subscapularis tendon

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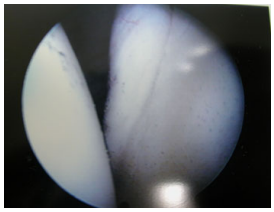
2872. (1456) Q7-1837:



Slide 1

An arthroscopic photo (Slide) looking from the posterior portal at the anterior inferior aspect of the glenoid is presented. What is the proper treatment in this case based on the finding:

1) Debridement
3) Open repair
2) Biceps tenotomy
5) No treatment necessary
4) Arthroscopic repair

The photo shows normal anterior inferior labrum; therefore, no treatment is necessary for this structure.Correct Answer: No treatment necessary

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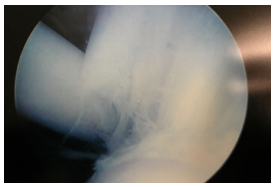
2873. (1457) Q7-1838:



Slide 1

An arthroscopic photo (Slide) looking from the posterior portal is presented. Identify the torn structure:

1) Middle glenohumeral ligament
3) Subscapularis tendon
2) Inferior glenohumeral ligament
5) Ligamentous pulley of long head biceps
4) Infraspinatus tendon

This photo demonstrates a torn ligamentous pulley that has possibly resulted in an unstable biceps tendon. Pathology of the ligamentous pulley is often associated with rotator cuff pathology.Correct Answer: Ligamentous pulley of long head biceps

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2874. (1458) Q7-1839:

When comparing anterior cruciate ligament (ACL) reconstruction using autogenous hamstrings and ACL reconstruction using autogenous patellar tendon, the most consistent difference is:

1) The patellar tendon group has more patellofemoral pain.
3) The patellar tendon group is more likely to return to activity.
2) The hamstring group has more loss of motion.
5) The hamstring group has better results with arthrometer testing.
4) The hamstring group has a higher incidence of graft failures.

Shaieb and associates recently reported a prospective randomized study comparing autogenous hamstring ACL reconstruction to autogenous patellar tendon ACL reconstruction. The only significant differences that were elicited between the groups at a minimum of 2-yearsâ follow-up were the incidences of patellofemoral pain and loss of motion, both in favor of the hamstring group.Correct Answer: The patellar tendon group has more patellofemoral pain.

2875. (1459) Q7-1841:

Muscle contusions are clinically graded according to:

1) Offending activity
3) Pain as determined by analog pain scale
2) Objective swelling
5) Range of motion of the adjacent joint
4) The degree of myositis ossificans

Muscle contusions are graded according to the range of motion of the adjacent joint.

Mild muscle contusion â two-thirds normal range of motion
Moderate muscle contusion â one-third to two-thirds normal range of motion
Severe muscle contusions â less than one-third normal range of motion

- The offending activity does not determine the grade of injury.
- Although swelling is variable, it is not the final determinant of grading.
- Pain is variable and unreliable in classifying muscle contusion.
- Although myositis ossificans is more often a result of more severe contusions, it is a later and infrequent finding.

Correct Answer: Range of motion of the adjacent joint

2876. (1460) Q7-1842:

The treatment protocol found to hasten recovery after quadriceps contusion is:

1) Extension protocol
3) Immobilization
2) Flexion protocol
5) Nonweight bearing protocol
4) Aggressive stretching protocol

An initial period of rest with the knee in flexion followed by rehabilitation focusing on regaining knee flexion has resulted in reduced morbidity and faster return to full activity.

- Extension protocols are associated with resultant longer recovery times.
- Immobilization is not associated with early recovery.
- Aggressive stretching increases morbidity and the formation of myositis ossificans.
- Nonweight bearing has not demonstrated decreased recovery times.

Correct Answer: Flexion protocol

2877. (1461) Q7-1843:

The differential diagnosis for patients presenting with radiographs consistent with myositis ossificans includes all of the following except:

1) Osteosarcoma
3) Osteomyelitis
2) Osteochondroma
5) Rhabdomyosarcoma
4) Chondrosarcoma

When evaluating a patient with calcification or ossification in abnormal regions, a thorough differential including all of the mentioned conditions should be considered.

- Osteochondromas will typically have an intramedullary canal continuous with the adjacent bone.
- Osteomyelitis will sometimes have associated constitutional symptoms.
- Osteosarcoma will typically have a radiodense center as opposed to the radiodense periphery of mature myositis ossificans.
- Chondrosarcoma can be confused with myositis ossificans.

Correct Answer: Rhabdomyosarcoma

2878. (1462) Q7-1844:

Findings associated with severe quadriceps contusions include:

1) Markedly decreased knee range of motion
3) Two-thirds of normal knee range of motion
2) Septic knee effusion
5) Decreased ankle range of motion
4) Decreased hip range of motion

A severe quadriceps contusion is defined as having less then one-third the normal knee range of motion and can be accompanied by a sympathetic knee effusion and, sometimes, a mild extensor lag.

- Two-thirds the normal knee range of motion is classified as a moderate quadriceps contusion.

Correct Answer: Markedly decreased knee range of motion

2879. (1463) Q7-1845:

The proposed site of pathology for athletes with groin pain and diagnosed with athletic pubalgia is:

1) Direct inguinal hernia
3) Rectus abdominus insertion and adductor longus muscle origin
2) Indirect inguinal hernia
5) Sartorius muscle
4) Pectineus muscle

Athletic pubalgia syndrome is the result of trunk hyperextension and thigh hyperabduction. This can result in injury to the rectus abdominus insertion and origin of the adductor longus muscle.

- By definition, a hernia is not present.
- The pectineus and sartorius muscles are not implicated in athletic pubalgia.

Correct Answer: Rectus abdominus insertion and adductor longus muscle origin

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2880. (1464) Q7-1846:

The initial management of athletic pubalgia consists of:

1) Modified Bassini hernia repair
3) Hip arthroscopy
2) Adductor release
5) Laparoscopic hernia repair
4) Core trunk stabilization and rest

The initial management of athletic pubalgia consists of a period of rest followed by core trunk stabilization, stretching, and gradual return to functional activities. Despite reports of low success rates after nonoperative treatment, this management must be instituted prior to surgical considerations.

- Reattachment of the inferolateral edge of the rectus using a modified Bassini repair has resulted in return to sports activities for the majority of patients, but the procedure should follow a nonoperative trial.
- Adductor release can be part of the operative approach after failure of nonoperative management.
- Hip joint pathology is not consistently associated with athletic pubalgia.

Correct Answer: Core trunk stabilization and rest

2881. (1465) Q7-1848:

The most common physical finding in patients with athletic pubalgia is:

1) Tenderness over the pubic tubercle
3) Tenderness to palpation of the adductor longus
2) Inguinal hernia
5) Pain with resisted sit-ups
4) Pain with resisted hip adduction

In a series of 157 high-performance athletes diagnosed with athletic pubalgia, 88% of patients had pain with resisted hip adduction. Peripubic tenderness was found in one-fourth of patients. By definition, a hernia is not present. Less than one-third of patients had tenderness at the origin of the adductor longus, and less than one-half of patients had pain with resisted sit-ups.Correct Answer: Pain with resisted hip adduction

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2882. (1466) Q7-1849:

Magnetic resonance imaging (MRI) of the pelvis in patients with athletic pubalgia reveals:

1) Pathology at the rectus abdominus in the majority of patients
3) Labral pathology
2) No abnormalities
5) Rectus abdominus pathology in 12% of patients and nonspecific findings in 90% of patients
4) Nonspecific findings in 25% of patients

Although only 12% of patients with athletic pubalgia will demonstrate MRI abnormalities, more than 90% of patients will have nonspecific findings localized to the symptomatic side. Labral pathology is not a common finding in patients diagnosed with athletic pubalgia.Correct Answer: Rectus abdominus pathology in 12% of patients and nonspecific findings in 90% of patients

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2883. (1467) Q7-1850:

Adductor longus tenotomy in athletes with chronic adductor pain resistant to nonoperative treatment results in:

1) Full objective strength
3) Return to full sports for most athletes despite decreased objective adductor strength
2) Return to sport at a lower level of play for most athletes
5) Unacceptable complication rates
4) Inability to return to sports

In a series of 16 athletes undergoing adductor tenotomy for chronic adductor symptoms, 12 patients returned to competitive sports at a mean 14 weeks after surgery. A decrease in objective strength was noted that did not affect functional results.Correct Answer: Return to full sports for most athletes despite decreased objective adductor strength

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2884. (1468) Q7-1851:

In order of frequency, the most common compartments involved in chronic exertional compartment syndrome are:

1) Deep posterior and anterior compartments
3) Anterior and superficial posterior compartments
2) Anterior and lateral compartments
5) Lateral and deep posterior compartments
4) Anterior and deep posterior compartments

The most common compartment involved in chronic exertional compartment syndrome in athletes is the anterior compartment followed by the deep posterior compartment and lateral compartments. The superficial posterior compartment is only rarely involved.Correct Answer: Anterior and deep posterior compartments

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2885. (1469) Q7-1852:

The resting pressure criteria for diagnosing chronic exertional compartment syndrome in athletes is equal to or greater than:

1) 10 mm Hg
3) 20 mm Hg
2) 15 mm Hg
5) 30 mm Hg
4) 25 mm Hg

The criteria for diagnosing chronic exertional compartment syndrome from compartment pressure measurements include one or more of the following:

- More than or equal to 15 mm Hg resting pressure
- A 1-minute postexercise pressure of more than or equal to 30 mm Hg
- A 5-minute postexercise pressure of more than or equal to 20 mm Hg

Correct Answer: 15 mm Hg

2886. (1470) Q7-1853:

The postexercise pressure measurement criteria for diagnosing chronic exertional compartment syndrome are:

1) More than 30 mm Hg at 1 minute
3) More than 20 mm Hg at 1 minute
2) More than 10mm Hg at 5 minutes
5) More than 10 mm Hg at 1 minute
4) More than 10 mm Hg at 10 Minutes

The criteria for diagnosing chronic exertional compartment syndrome from compartment pressure measurements includes one or more of the following:

- More than or equal to 15 mm Hg resting pressure
- A 1-minute postexercise pressure of more than or equal to 30 mm Hg
- A 5-minute postexercise pressure of more than or equal to 20 mm Hg

Correct Answer: More than 30 mm Hg at 1 minute

2887. (1471) Q7-1854:

Success rates after fasciotomy for chronic exertional compartment syndrome are highest for which compartment:

1) Deep posterior compartment
3) Anterior compartment
2) Superficial posterior compartment
5) Equally successful for any compartment
4) Fasciotomy shown to be unsuccessful

In a series of patients undergoing fasciotomy for anterior or deep posterior chronic exertional compartment syndrome, satisfactory results were obtained in 96% and 65% of patients, respectively. The superficial posterior compartment is rarely involved.Correct Answer: Anterior compartment

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2888. (1472) Q7-1855:

Which of the following is not a common finding in patients presenting with chronic exertional compartment syndrome:

1) Aching or cramping pain during exercise
3) Numbness or weakness on initial examination
2) Relief with rest
5) Occasional numbness with activity
4) Increased compartment pressure post exercise

Patients with chronic exertional compartment syndrome will give a history of cramping or aching pain and occasional numbness with exercise. The symptoms typically resolve within minutes of rest. Most patients will have a normal initial examination unless they have exercised minutes prior to evaluation. Increased postexercise compartment pressures are diagnostic.Correct Answer: Numbness or weakness on initial examination

2889. (1473) Q7-1856:

The initial recommended treatment for a grade 3 acute lateral ankle sprain is:

1) Acute lateral ankle reconstruction
3) Functional bracing and rehabilitation
2) Acute lateral ankle repair (modified Brostrom)
5) Weight bearing cast for 6 weeks
4) Nonweight bearing cast for 3 months

A review of 12 prospective studies comparing surgery, casting, and functional bracing with early range of motion revealed 75% to 100% excellent or good results regardless of treatment. The final recommendation was functional bracing.Correct Answer: Functional bracing and rehabilitation

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2890. (1474) Q7-1857:

Earlier return to work and sport is reported after which treatment for acute lateral ligament sprain:

1) Acute lateral ankle reconstruction
3) Functional bracing and rehabilitation
2) Acute lateral ankle repair (modified Brostrom)
5) Weight bearing cast for 6 weeks
4) Nonweight bearing cast for 3 months

Studies comparing surgery, immobilization, and early weight bearing and range of motion have shown that early weight bearing and range of motion result in earlier return to sport and work when compared to acute operative management or cast immobilization.Correct Answer: Functional bracing and rehabilitation

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2891. (1475) Q7-1858:

Which of the following leads to lower success rates after lateral ankle ligament repair (modified Brostrom):

1) Recurrent instability
3) Male gender
2) Younger age
5) History of bilateral ankle sprains
4) Generalized ligamentous laxity

Patients with generalized ligamentous laxity have fewer satisfactory results after a modified Brostrom repair. Overall, 91% of patients had good to excellent results after this procedure, but none of the five patients with generalized ligamentous laxity had an excellent result.Correct Answer: Generalized ligamentous laxity

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2892. (1476) Q7-1859:

With regard to the level of athletics, which group of patients can be expected to have less satisfactory results after lateral ankle repair using a modified Brostrom technique:

1) Professional dancers
3) Non-athletes
2) Recreational athletes
5) All groups can be expected to have similar success
4) Professional athletes

In a series of 28 ankles undergoing a modified Brostrom repair for lateral ankle instability, there were no significant differences in outcome whether the patients were professional dancers, athletes, or non-athletes.Correct Answer: All groups can be expected to have similar success

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2893. (1477) Q7-1860:

The foot and ankle position that is most likely to result in disruption of the anterior talofibular ligament is:

1) Plantarflexion and eversion
3) Plantarflexion and inversion
2) Dorsiflexion and inversion
5) The anterior talofibular ligament is uncommonly injured after an ankle sprain.
4) Dorsiflexion and eversion

Strain in the anterior talofibular ligament increases with plantarflexion, inversion, and internal rotation. It is the primary restraint to anterior displacement, internal rotation, and inversion of the talus at all angles of flexion and is the most commonly injured ligament as a result of inversion ankle sprains.Correct Answer: Plantarflexion and inversion

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2894. (1478) Q7-1861:

Which of the following arteries provides the primary blood supply to the supraspinatus tendon:

1) Scapular circumflex artery
3) Suprascapular artery
2) Anterior humeral circumflex artery
5) Posterior humeral circumflex artery
4) Thoracoacromial artery

The suprascapular artery provides the primary vascular supply to the supraspinatus tendon. The vascularity predominates on the bursal side, while the articular side is hypovascular.Correct Answer: Suprascapular artery

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2895. (4043) Q7-1863:

Thermal shrinkage of the shoulder capsule imparts which of the following properties on the capsule:

1) Increased strength
3) Increased collagen crosslinking
2) Decreased compliance
5) Decreased stiffness
4) Increased stiffness

Thermal shrinkage reliably decreases capsular stiffness (increasing compliance). The resultant tissue is biomechanically weaker than normal tissue.Correct Answer: Decreased stiffness

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2896. (1479) Q7-1864:

Ligaments and joint capsule are primarily composed of collagen. What is the predominant type of collagen in these structures:

1) Type I
3) Type V
2) Type II
5) Type IX
4) Type VI

As thermal modification of soft tissue becomes a common procedure, orthopedic surgeons must have an understanding of collagen. Type I collagen predominates in ligaments, joint capsule, bone, tendon, meniscus, annulus of intervertebral disks, and skin. Type II collagen predominates in articular cartilage and nucleus pulposus of intervertebral disks. Type V collagen is found in small amounts in articular cartilage, as is types VI and IX.Correct Answer: Type I

2897. (1480) Q7-1867:

Magnetic resonance imaging will demonstrate labral abnormalities in the throwing shoulder in approximately what percentage of asymptomatic professional baseball pitchers:

1) 10%
3) 50%
2) 30%
5) 90%
4) 75%

Miniaci and colleagues discovered that 79% of asymptomatic professional baseball pitchers had labral abnormalities on magnetic resonance imaging. They further discovered that the incidence of labral lesions was similar between throwing and nonthrowing shoulders in this population.Correct Answer: 75%

2898. (1481) Q7-1869:

To avoid injury associated with repetitive internal impingement, the pitcherâs long humeral axis must be in which position during the late cocking phase of throwing:

1) 20Â° extended relative to the plane of the scapula
3) Parallel to the plane of the scapula
2) 10Â° extended relative to the plane of the scapula
5) 20Â° flexed relative to the plane of the scapula
4) 10Â° flexed relative to the plane of the scapula

Hyperangulation during the late cocking phase of throwing can result in impingement of the greater tuberosity on the posterosuperior glenoid rim leading to labral or rotator cuff lesions. Positioning of the humeral axis parallel to the plane of the scapula is recommended to avoid injury associated with internal impingement.Correct Answer: Parallel to the plane of the scapula

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2899. (1482) Q7-1870:

Which of the following factors is related to recurrence after primary anterior shoulder dislocation:

1) Type of sport practiced
3) Treatment with physical therapy
2) Treatment with immobilization
5) Patient age
4) Patient gender

The only known factor that statistically correlates with recurrence of anterior shoulder instability is patient age at the time of initial dislocation. A recent study demonstrated that patients having an initial dislocation during the third decade have more than a 60% chance of redislocating. The type of sport practiced, type of nonoperative treatment, and patient gender do not influence recurrence rate.Correct Answer: Patient age

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2900. (1483) Q7-1872:

Use of functional knee bracing after anterior cruciate ligament (ACL) reconstruction will most likely result in which of the following scenarios:

1) Better range of motion at the 2-year follow-up
3) Better knee function at the 2-year follow-up
2) Better knee stability at the 2-year follow-up
5) More quadriceps atrophy at the 3-month follow-up
4) More knee pain at the 3-month follow-up

Two-year follow-up has failed to show any differences in range of motion, stability, function, strength, pain, or atrophy in patients who were braced after ACL reconstruction vs. patients who were treated without a brace. The only difference between the two groups is that the braced group has better knee function in the early postoperative period, despite having more quadriceps atrophy.Correct Answer: More quadriceps atrophy at the 3-month follow-up

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2901. (1484) Q7-1874:

The stabilizing ligamentous pulley of the long head of the biceps at the shoulder is composed of fibers from all of the following structures except:

1) Superior glenohumeral ligament
3) Coracohumeral ligament
2) Middle glenohumeral ligament
5) Supraspinatus tendon
4) Subscapularis tendon

The stabilizing ligamentous pulley system of the long head of the biceps at the shoulder is a coalescence of the coracohumeral ligament and superior glenohumeral ligament. It also receives fiber contributions from the supraspinatus and subscapularis tendons.Correct Answer: Middle glenohumeral ligament

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2902. (1485) Q7-1875:

Which of the following is the principal function of the biceps during throwing:

1) Elbow flexion
3) Arm deceleration
2) Shoulder stabilization
5) Shoulder flexion
4) Humeral head depression

The function of the biceps at the shoulder is controversial, especially in the throwing athlete. The biceps may act as a secondary shoulder stabilizer, weak shoulder flexor, arm decelerator, or weak depressor of the humeral head. However, it is widely agreed upon that the biceps principal function during throwing is elbow flexion.Correct Answer: Elbow flexion

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2903. (1486) Q7-1876:

Which of the following arteries provides the main vascular supply to the humeral head:

1) Ascending branch of the posterior humeral circumflex artery
3) Ascending branch of the anterior humeral circumflex artery
2) Descending branch of the posterior humeral circumflex artery
5) Ascending intramedullary artery
4) Descending branch of the anterior humeral circumflex artery

The ascending branch of the anterior humeral circumflex artery provides the main vascular supply to the humeral head. Disruption of this blood supply can result in osteonecrosis of the humeral head.Correct Answer: Ascending branch of the anterior humeral circumflex artery

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2904. (1487) Q7-1877:

When assessing patient outcomes after rotator cuff repair, which of the following is not related to poor functional outcome:

1) Workmanâs compensation
3) Male gender
2) Revision rotator cuff repair
5) Age younger than 55 years at the time of repair
4) Age older than 55 years at the time of repair

A large outcome study of more than 600 rotator cuff repairs demonstrated that workmanâs compensation, revision surgery, male gender, and age younger than 55 years at the time of repair are factors contributing to poor functional outcome and decreased workability following rotator cuff repair.Correct Answer: Age older than 55 years at the time of repair

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2905. (1488) Q7-1878:

When using open measurement as the standard, which of the following is the most reliable instrument to measure rotator cuff tear size:

1) Arthroscopy
3) Ultrasonography
2) Magnetic resonance imaging
5) Clinical examination
4) Computed tomography

Of the modalities listed, arthroscopy most closely estimates the actual size of a rotator cuff tear. Magnetic resonance imaging and ultrasound are similar in their ability to determine rotator cuff tear size. Computed tomography (without arthrography) is poor in evaluation of the rotator cuff. A detailed clinical examination is helpful in determining which tendons are torn, however elucidation of the specific size of the tear on physical examination is unlikely.Correct Answer: Arthroscopy

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2906. (1489) Q7-1879:

When biomechanically comparing reconstruction of the anterior band of the medial collateral ligament of the elbow to the intact ligament, the reconstructed ligament behaves nearly identical to the intact ligament when subjected to valgus stress at all of the following degrees of elbow flexion except:

1) 0Â°
3) 60Â°
2) 30Â°
5) 120Â°
4) 90Â°

Mullen and associates biomechanically compared reconstruction of the medial collateral ligament of the elbow to the intact ligament at 30Â°, 60Â°, 90Â°, and 120Â° of elbow flexion. They identified a significant difference in displacement with an applied valgus load at 120Â° of elbow flexion, leading them to conclude that medial collateral ligament reconstruction is a biomechanically sound procedure.Correct Answer: 120Â°

2907. (1490) Q7-1880:

Which of the following is the most commonly reported cause of nontraumatic humeral head osteonecrosis:

1) Alcohol abuse
3) Gaucherâs disease
2) Corticosteroid therapy
5) Hemoglobinopathies
4) Smoking

Corticosteroid therapy is the most commonly reported cause of osteonecrosis of the humeral head. Other risk factors include alcohol abuse, hemoglobinopathies, Gaucherâs disease, dysbarism, connective tissue disorders, arteritis, vasculitis, hypercoagulability, prior radiation, pregnancy, and pancreatitis.Correct Answer: Corticosteroid therapy

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2908. (1491) Q7-1881:

The microfracture technique for articular cartilage lesions is most successful for which chondral lesions:

1) 2 cm diameter
3) Kissing lesions
2) Smaller than a 2 cm diameter
5) Partial thickness chondral lesions
4) Loss of subchondral bone integrity

The inventors of the microfracture technique described a 70% to 80% success rate after microfracture of lesions smaller than 2 cm in diameter. The technique involves maintenance of some subchondral bone integrity and is indicated for full thickness chondral lesions. Lesions involving both the tibia and femur have resulted in less satisfactory outcomes.Correct Answer: Smaller than a 2 cm diameter

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2909. (1492) Q7-1882:

The results of anteromedial tibial tubercle transfer for patellar malalignment are best when patellar lesions are located:

1) Distally on the lateral facet
3) Proximally on the medial facet
2) Proximally on the lateral facet
5) Proximally on either facet
4) Distally on the medial facet

A study revealed that results after tibial tubercle anteromedialization are best if patellar lesions are located distally or laterally. The results were poor when the lesions were located proximally or on the medial facet.Correct Answer: Distally on the lateral facet

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2910. (1493) Q7-1883:

The following structures are found in the superficial layer of the posterolateral corner:

1) The biceps tendon and fabellofibular ligament
3) The iliotibial tract and biceps tendon
2) The patellofemoral ligaments and quadriceps retinaculum
5) The popliteofibular ligament and biceps tendon
4) The joint capsule and fabellofibular ligament

An anatomic study described three distinct layers that compose the posterolateral corner of the knee. Layer one includes the biceps tendon, the iliotibial tract, the prepatellar bursa, and peroneal nerve. Layer two includes the quadriceps retinaculum and patellofemoral ligaments. Layer three, the deepest layer, includes the lateral part of the joint capsule, the popliteus tendon passing through the hiatus, the fibular collateral ligament, the fabellofibular ligament, arcuate complex, and popliteofibular ligament.Correct Answer: The iliotibial tract and biceps tendon

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2911. (1494) Q7-1884:

The following structures are found in the second, or middle layer, of the posterolateral corner:

1) The biceps tendon and fabellofibular ligament
3) The iliotibial tract and biceps tendon
2) The patellofemoral ligaments and quadriceps retinaculum
5) The popliteofibular ligament and biceps tendon
4) The joint capsule and fabellofibular ligament

An anatomic study described three distinct layers that compose the posterolateral corner of the knee. Layer one includes the biceps tendon, the iliotibial tract, the prepatellar bursa, and peroneal nerve. Layer two includes the quadriceps retinaculum and patellofemoral ligaments. Layer three, the deepest layer, includes the lateral part of the joint capsule, the popliteus tendon passing through the hiatus, the fibular collateral ligament, the fabellofibular ligament, arcuate complex, and popliteofibular ligament.Correct Answer: The patellofemoral ligaments and quadriceps retinaculum

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2912. (1495) Q7-1885:

The following structures are found in the deep layer of the posterolateral corner:

1) The biceps tendon and fabellofibular ligament
3) The iliotibial tract and biceps tendon
2) The patellofemoral ligaments and quadriceps retinaculum
5) The popliteofibular ligament and biceps tendon
4) The joint capsule and fabellofibular ligament

An anatomic study described three distinct layers that compose the posterolateral corner of the knee. Layer one includes the biceps tendon, the iliotibial tract, the prepatellar bursa, and peroneal nerve. Layer two includes the quadriceps retinaculum and patellofemoral ligaments. Layer three, the deepest layer, includes the lateral part of the joint capsule, the popliteus tendon passing through the hiatus, the fibular collateral ligament, the fabellofibular ligament, arcuate complex, and popliteofibular ligament.Correct Answer: The joint capsule and fabellofibular ligament

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2913. (1496) Q7-1886:

Sectioning the posterolateral structures alone affects lateral tibial plateau translation with:

1) Increased anterior translation at 30Â° knee flexion
3) Increased posterior translation at 30Â° knee flexion
2) Increased posterior translation at 90Â° knee flexion
5) No change in translation of the knee
4) Increased anterior translation at 90Â° knee flexion

Biomechanical studies show that sectioning the posterolateral structures alone results in increases in posterior translation of the lateral tibial plateau primarily at 30Â° of knee flexion.Correct Answer: Increased posterior translation at 30Â° knee flexion

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2914. (1497) Q7-1887:

Sectioning the posterolateral structures and posterior cruciate ligament results in:

1) Increased posterior tibial translation at 30Â°
3) Increased posterior tibial translation at 30Â° and 90Â°
2) Increased posterior tibial translation at 90
5) Increased anterior tibial translation at 30Â° and 90
4) No increase in tibial translation

Biomechanical studies show that sectioning the posterolateral structures and posterior cruciate ligament results in increases in posterior translation of the medial and lateral tibial plateaus at 30Â° and 90Â° of knee flexion.Correct Answer: Increased posterior tibial translation at 30Â° and 90Â°

2915. (1498) Q7-1888:

The maximal restraint to varus stress provided by the posterolateral structures of the knee is at what degree of knee flexion:

1) 0Â°
3) 45Â°
2) 30Â°
5) 90Â°
4) 60Â°

Biomechanical studies show that sectioning the posterolateral structures results in increases in varus rotation of the knee from 0Â° to 30Â° of knee flexion, with maximal increase observed at 30Â°.Correct Answer: 30Â°

2916. (1499) Q7-1889:

The reverse pivot shift is most useful for diagnosing which of the following knee injuries:

1) Anterior cruciate ligament injuries
3) Medial collateral ligament injuries
2) Posterior cruciate ligament injuries
5) Meniscal injuries
4) Posterolateral corner injuries

The reverse pivot shift is positive if there is a palpable shift or jerk as the lateral tibial plateau reduces while bringing the knee from 90Â° of flexion to full extension with the foot in external rotation. This is indicative of posterolateral corner knee injury but has been reported to be positive in 11% to 35% of normal asymptomatic patients.Correct Answer: Posterolateral corner injuries

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2917. (1500) Q7-1890:

When using the tibial external rotation test on a patient, increased external rotation at 30Â° but not at 90Â° of knee flexion is indicative of:

1) Anterior cruciate ligament injury
3) Isolated posterolateral corner injury
2) Posterior cruciate ligament injury
5) Anterior cruciate and posterior cruciate ligament injury
4) Posterior cruciate and posterolateral corner injury

The tibial external rotation test is performed at 30Â° and 90Â° of knee flexion. The degree of foot external rotation with regard to the femur is evaluated. Increased external rotation at 30Â° is consistent with an isolated posterolateral corner injury. Increased external rotation at 30Â° and 90Â° is consistent with a combined posterolateral and posterior cruciate ligament injury.Correct Answer: Isolated posterolateral corner injury

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2918. (1501) Q7-1891:

When using the tibial external rotation test on a patient, increased external rotation at 30Â° and 90Â° of knee flexion is indicative of:

1) Anterior cruciate ligament injury
3) Isolated posterolateral corner injury
2) Posterior cruciate ligament injury
5) Anterior cruciate and posterior cruciate ligament injury
4) Posterior cruciate and posterolateral corner injury

The tibial external rotation test is performed at 30Â° and 90Â° of knee flexion. The degree of foot external rotation with regard to the femur is evaluated. Increased external rotation at 30Â° is consistent with an isolated posterolateral corner injury. Increased external rotation at 30Â° and 90Â° is consistent with a combined posterolateral and posterior cruciate ligament injury.Correct Answer: Posterior cruciate and posterolateral corner injury

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2919. (1502) Q7-1893:

The recommended treatment for an acute combined anterior cruciate ligament and complete posterolateral corner disruption in a young athlete is:

1) Anterior cruciate ligament reconstruction alone
3) Anterior cruciate ligament reconstruction and posterolateral corner repair
2) Nonoperative treatment emphasizing quadriceps strengthening
5) Posterolateral corner repair alone
4) Anterior cruciate ligament repair and posterolateral corner repair

In cases of combined cruciate ligament and posterolateral corner injuries, most surgeons recommend addressing both injuries. In one study, the most common cause of anterior cruciate ligament failure was unrecognized and untreated concomitant posterolateral corner injuries.Correct Answer: Anterior cruciate ligament reconstruction and posterolateral corner repair

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2920. (1503) Q7-1894:

The ideal timing for repair of an acute posterolateral corner knee injury is:

1) In the first 3 weeks
3) 8 to 12 weeks
2) 4 to 6 weeks
5) Surgery is rarely needed for complete posterolateral corner injuries.
4) Acute repair is unsuccessful, and late reconstruction is recommended.

Surgical repair of posterolateral corner injuries is recommended within the first several weeks because dissection can be difficult and can result in the need for a reconstruction with longer delays. Results of chronic posterolateral corner injury repairs are inferior to those for acute posterolateral corner injuries.Correct Answer: In the first 3 weeks

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2921. (1504) Q7-1895:

Which of the following exercises must be delayed for up to 3 months after posterolateral corner repair or reconstruction of the knee:

1) Range of motion exercises
3) Closed chain quadriceps exercises
2) Isometric quadriceps exercises
5) All of the above answers should be started immediately
4) Hamstring exercises

Postoperative rehabilitation for posterolateral corner repair or reconstruction involves early protected or nonweight bearing, early range of motion exercises, and quadriceps exercises. Avoidance of hamstring exercises for up to 12 weeks is recommended to decrease external rotational torque and posterior subluxation forces at the knee joint.Correct Answer: Hamstring exercises

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2922. (1505) Q7-1896:

For patients who sustain a knee dislocation, the role of clinical history, physical examination, and magnetic resonance imaging (MRI) is:

1) Both physical examination and MRI are important, but physical examination is much more accurate.
3) Both physical examination and MRI are important, but MRI is more accurate.
2) Neither physical examination or MRI is very accurate.
5) Clinical history is the more important than MRI.
4) There is no role for MRI.

In a study of 17 knee dislocations, the accuracy of clinical examination ranged from 53% to 82% correct compared to an accuracy of 85% to 100% with MRI. The limitations of clinical examination were mainly due to associated injuries.Correct Answer: Both physical examination and MRI are important, but MRI is more accurate.

2923. (1506) Q7-1897:

After high velocity knee dislocations, there is serious injury to the popliteal vessels in approximately what percentage of patients:

1) 5%
3) 30%
2) 10%
5) More than 90%
4) 75%

After reviewing several series from 1963 to 1992, investigators found serious injury to the popliteal vessels in approximately 30% of cases and peroneal nerve injuries in 25% of cases. The incidence of arterial and nerve injury with lower velocity mechanisms (some athletic injuries) is lower.Correct Answer: 30%

2924. (1507) Q7-1898:

After high velocity knee dislocations, there is serious injury to the peroneal nerve in approximately what percentage of patients:

1) Serious injury has not been reported.
3) 25%
2) 5%
5) More than 90%
4) 75%

After reviewing several series from 1963 to 1992, investigators found serious injury to the popliteal vessels in approximately 30% of cases and peroneal nerve injuries in 25% of cases. The incidence of arterial and nerve injury with lower velocity mechanisms (some athletic injuries) is lower.Correct Answer: 25%

2925. (1508) Q7-1899:

The strongest bundle in the posterior cruciate ligament is the:

1) Anteromedial bundle
3) Anterolateral bundle
2) Posteromedial bundle
5) Both bands are of equal strength
4) Posterolateral bundle

The posterior cruciate ligament is made up of two bundles (anterolateral and posteromedial) that are named according to their origin on the femur and insertion on the tibia. The anterolateral bundle is the larger and stronger of the two bundles. The anterolateral bundle is tight in flexion, and the posteromedial bundle is tight in extension.Correct Answer: Anterolateral bundle

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2926. (1509) Q7-1900:

In the posterior cruciate ligament the anterolateral bundle is tight in _____ and the posteromedial bundle is tight in _____:

1) Flexion, extension
3) Extension, extension
2) Extension, flexion
5) Neither bundle tightens throughout the kneeâs range of motion.
4) Flexion, flexion

The posterior cruciate ligament is made up of two bundles (anterolateral and posteromedial) that are named according to their origin on the femur and insertion on the tibia. The anterolateral bundle is the larger and stronger of the two bundles. The anterolateral bundle is tight in flexion, and the posteromedial bundle is tight in extension.Correct Answer: Flexion, extension

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2927. (1576) Q7-1970:

When applying valgus stress, over which arc of motion is the anterior band of the anterior oblique component of the ulnar collateral ligament of the elbow under tension:

1) 0Â° to 20Â°
3) 0Â° to 85Â°
2) 0Â° to 45Â°
5) 55Â° to 145Â°
4) 55Â° to 115Â°

Biomechanical studies demonstrate that the anterior band of the oblique component of the ulnar collateral ligament of the elbow is at greatest tension from full extension to 85Â° of elbow flexion.Correct Answer: 0Â° to 85Â°

2928. (1577) Q7-1971:

When applying valgus stress, over which arc of motion is the posterior band of the anterior oblique component of the ulnar collateral ligament of the elbow under tension:

1) 0Â° to 35Â°
3) 0Â° to 85Â°
2) 0Â° to 65Â°
5) 55Â° to 145Â°
4) 55Â° to 85Â°

Biomechanical studies demonstrate that the posterior band of the oblique component of the ulnar collateral ligament of the elbow is at greatest tension from 55Â° to full elbow flexion.Correct Answer: 55Â° to 145Â°

2929. (1578) Q7-1972:

Which of the following structures is the main stabilizer of the elbow to valgus stress:

1) Anterior oblique component of the ulnar collateral ligament
3) Transverse oblique component of the ulnar collateral ligament
2) Posterior oblique component of the ulnar collateral ligament
5) Radiohumeral articulation
4) Ulnohumeral articulation

The anterior oblique component of the ulnar collateral ligament is the most important stabilizer of the elbow to valgus stress. The most important secondary stabilizer is the radiohumeral articulation. The transverse oblique component of the ulnar collateral ligament imparts little stability to the elbow.Correct Answer: Anterior oblique component of the ulnar collateral ligament

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2930. (1579) Q7-1973:

Disruption of which of the following ligaments represents the primary lesion in posterolateral rotatory instability of the elbow:

1) Radial collateral ligament
3) Annular ligament
2) Radial ulnohumeral ligament
5) Ulnohumeral articulation
4) Accessory radial collateral ligament

OâDriscoll and associates demonstrated that the radial ulnohumeral ligament must be disrupted to produce posterolateral rotatory instability of the elbow.Correct Answer: Radial ulnohumeral ligament

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2931. (1580) Q7-1974:

Elbow injury usually occurs during which phase of throwing:

1) Wind-up
3) Late cocking
2) Early cocking
5) Follow through
4) Acceleration

Peak valgus stresses on the elbow occur during the acceleration phase of throwing making it the phase during which the elbow is most vulnerable to injury.Correct Answer: Acceleration

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2932. (1581) Q7-1975:

Which of the following structures is the most important dynamic stabilizer of the elbow to valgus stresses during throwing:

1) Anterior oblique component of the ulnar collateral ligament
3) Flexor-pronator musculature
2) Posterior oblique component of the ulnar collateral ligament
5) Biceps brachii
4) Brachialis

The flexor-pronator muscle mass on the medial side of the elbow dynamically resists valgus stresses during throwing. Compromise or fatigue of this muscle group with activity may be a predecessor to injury to the ligamentous stabilizing structures.Correct Answer: Flexor-pronator musculature

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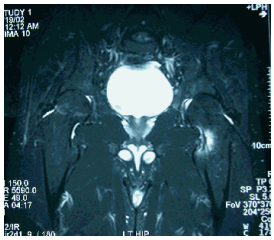
2933. (1582) Q7-1976:



Slide 1

The following is a hip magnetic resonance image (MRI) of a 28-year-old male triathlete who has noticed progressive activity-related left hip pain. Recommended treatment includes:

1) Arthroscopic debridement
3) Percutaneous pinning in situ
2) Open reduction internal fixation
5) Continuation of current training regimen
4) Period of nonweight bearing with continued observation

The MRI depicts a compression sided incomplete femoral neck fracture. Compression sided fractures of the femoral neck are treated with nonweight bearing and close observation. In the advent of fracture line extension, these fractures must be urgently percutaneously pinned. Complete stress fractures and incomplete tension sided fractures of the femoral neck must be urgently percutaneously pinned.Correct Answer: Period of nonweight bearing with continued observation

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2934. (1583) Q7-1977:

Slide 1 **Slide 2**

The following radiographs are of a 19-year-old female collegiate distance runner who complained of pain in her right distal tibia. She reports having shin splints 2 years earlier that affected her right proximal tibia. She has been unable to run secondary to symptoms for 3 weeks. She reports being amenorrheic for approximately the last 3 years. Which of the following should be included in her initial treatment regimen:

1) Treatment with nonsteroidal anti-inflammatory medications
3) Intramedullary nailing with bone grafting
2) Localized steroid injection
5) Initiation of hormone replacement therapy
4) Continuation of current training regimen

This individual has a distal tibial stress fracture as evidenced by the early periosteal reaction shown on radiography. Radiographs also show a healed proximal tibial stress fracture. Amenorrhea is a risk factor for stress fractures and should be addressed with hormone replacement therapy. The other possible answers are inappropriate for initial treatment.Correct Answer: Initiation of hormone replacement therapy

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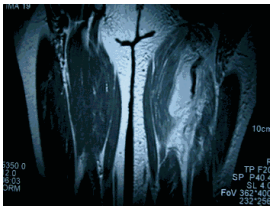
2935. (1584) Q7-1978:



Slide 1

The following figure is the magnetic resonance image (MRI) of a 40-year-old avid female water-skier who felt a pop in her left hip as she was pulled over the front of her ski. Recommended treatment includes:

1) Percutaneous pinning
3) Physical therapy
2) Nonweight bearing crutch ambulation
5) Reassurance and symptomatic treatment
4) Operative repair of the injured structures

The MRI shows a complete avulsion of the hamstring tendons off the ischial tuberosity. In active individuals, operative repair is recommended for complete avulsions. Nonoperative treatment of complete hamstring avulsion injury yields a low rate of return to sport at preinjury activity level.Correct Answer: Operative repair of the injured structures

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2936. (1585) Q7-1979:

During which phase of throwing is the flexor-pronator muscle mass most electrically active:

1) Wind-up
3) Late cocking
2) Early cocking
5) Follow through
4) Acceleration

Peak valgus stresses on the elbow occur during the acceleration phase of throwing making it the phase during which the elbow is most vulnerable to injury. The flexor-pronator muscle mass peaks in activity during the acceleration phase to dynamically stabilize the elbow.Correct Answer: Acceleration

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2937. (1586) Q7-1980:

Which of the following is a risk factor for anterior cruciate ligament (ACL) injury in noncontact athletes:

1) Smaller than average cross sectional size of the ACL
3) Smaller than average diameter of the femoral notch
2) High shoe-surface coefficient of friction
5) Failure to modify activity of female athletes during certain phases of the menstrual cycle
4) Failure to use a knee brace

A high coefficient of friction at the shoe-surface interface is a risk factor for ACL injury in noncontact athletes. Insufficient evidence exists to definitively implicate the other possible answers as risk factors.Correct Answer: High shoe-surface coefficient of friction

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2938. (1587) Q7-1981:

Which of the following regimens is recommended for maintenance of cadiorespiratory fitness:

1) 30 to 60 minutes of exercise 3 to 5 days per week at 60% to 90% of maximum heart rate
3) 90 to 120 minutes of exercise 3 to 5 days per week at 60% to 90% of maximum heart rate
2) 30 to 60 minutes of exercise 7 days per week at 20% to 50% of maximum heart rate
5) 15 to 20 minutes of exercise 3 to 5 days per week at 60% to 90% of maximum heart rate
4) 30 to 60 minutes of exercise 1 day per week at 60% to 90% of maximum heart rate

Current recommendations for maintenance of cardiorespiratory fitness include 30 to 60 minutes of exercise 3 to 5 days per week at 60% to 90% of maximum heart rate.Correct Answer: 30 to 60 minutes of exercise 3 to 5 days per week at 60% to 90% of maximum heart rate

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2939. (1588) Q7-1982:

All of the following muscles act in scapular retraction except:

1) Trapezius
3) Rhomboideus minor
2) Rhomboideus major
5) Pectoralis minor
4) Levator scapulae

The trapezius, rhomboids, and levator scapulae all provide some degree of scapular retraction. The pectoralis minor is a scapular protractor.Correct Answer: Pectoralis minor

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2940. (1589) Q7-1983:

A 20-year-old male distance runner complains of pain on the lateral aspect of his knee that reliably occurs 3 miles into his run and eventually causes him to terminate his run. The pain is made worse by running downhill. He recalls no injury to his knee and has noticed no swelling. What is the most likely diagnosis:

1) Lateral meniscus tear
3) Iliotibial band tendinitis
2) Lateral collateral ligament sprain
5) Exertional compartment syndrome
4) Lateral parapatellar plica

Iliotibial band tendinitis is the most common cause of lateral knee pain in runners. It generally occurs a few miles into a run and is exacerbated with downhill running. Iliotibial band tendinitis generally responds to nonoperative treatment consisting of stretching and nonsteroidal anti-inflammatory drugs but may require a corticosteroid injection or, rarely, surgical treatment.Correct Answer: Iliotibial band tendinitis

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2941. (1590) Q7-1984:

Outcome following arthroscopic treatment of superior labrum anterior to posterior (SLAP) lesions is most affected by which of the following factors:

1) Patient gender
3) Participation in overhead sports
2) Level of sports participation
5) Time to return to activity following surgery
4) Dominance of involved arm

Kim and colleagues reported on the results of 34 patients who underwent arthroscopic treatment of SLAP lesions and discovered that results were good in all patients, but individuals who participated in overhead sports did not have outcomes as good as those not participating in these types of activities.Correct Answer: Participation in overhead sports

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2942. (1591) Q7-1985:

Inversion injury of a plantarflexed foot results in disruption of the anterolateral capsuloligamentous structures in a sequential fashion. Which of the following is the order in which this disruption occurs:

1) Anterolateral joint capsule, anterior talofibular ligament, calcaneofibular ligament
3) Anterolateral joint capsule, calcaneofibular ligament, anterior talofibular ligament
2) Anterior talofibular ligament, anterolateral joint capsule, calcaneofibular ligament
5) Calcaneofibular ligament, anterolateral joint capsule, anterior talofibular ligament
4) Calcaneofibular ligament, anterior talofibular ligament, anterolateral joint capsule

Inversion injury to the plantarflexed foot results in a predictable, sequential pattern of injury. Injury is initiated anteriorly with disruption of the anterolateral joint capsule and progresses posteriorly to the anterior talofibular ligament and ultimately to the calcaneofibular ligament.Correct Answer: Anterolateral joint capsule, anterior talofibular ligament, calcaneofibular ligament

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2943. (1592) Q7-1986:

When treating recurrent inversion ankle sprains, physiotherapy should be directed at strengthening of which muscle or muscle group:

1) Gastrosoleus
3) Tibialis posterior
2) Tibialis anterior
5) Flexor digitorum longus
4) Peroneals

The peroneals provide dynamic resistance to inversion of the ankle. Therapy programs designed for treating lateral ankle instability must attempt to maximize the function of these dynamic stabilizers.Correct Answer: Peroneals

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2944. (1593) Q7-1987:

All of the following are either primary or secondary stabilizers of the knee to posterior translation except:

1) Posterior cruciate ligament
3) Medial collateral ligament
2) Anterior cruciate ligament
5) Posterolateral corner
4) Lateral collateral ligament

The posterior cruciate ligament is the primary stabilizer to posterior translation of the knee. Secondary stabilizers include the medial and lateral collateral ligaments and the posterolateral corner.Correct Answer: Anterior cruciate ligament

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2945. (1594) Q7-1988:

Which of the following most accurately describes the location of the tibial attachment of the posterior cruciate ligament:

1) At the level of the tibial plateau
3) 5 mm to 10 mm inferior to the level of the tibial plateau
2) 0 mm to 5 mm inferior to the level of the tibial plateau
5) 15 mm to 20 mm inferior to the level of the tibial plateau
4) 10 mm to 15 mm inferior to the level of the tibial plateau

The tibial attachment of the posterior cruciate ligament is usually 10 mm to 15 mm inferior to the joint line. Reconstructions of the posterior cruciate ligament should attempt to replicate this tibial attachment site.Correct Answer: 10 mm to 15 mm inferior to the level of the tibial plateau

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2946. (1595) Q7-1989:

Which of the following is the most accurate clinical examination tool in detecting disruption of the posterior cruciate ligament:

1) Posterior drawer test
3) Posterior sag test
2) Quadriceps active drawer test
5) Reverse Lachman test
4) Reverse pivot shift test

The posterior drawer test is the most accurate method of clinically diagnosing posterior cruciate ligament disruption. Although the quadriceps active drawer test and the posterior sag test are useful, their reported accuracy is less than that of the posterior drawer test. The reverse pivot shift test evaluates posterolateral corner injuries.Correct Answer: Posterior drawer test

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2947. (1596) Q7-1990:

Completely lacerated muscles recover _____% of their strength and ___% of their ability to shorten:

1) 50, 80
3) 10, 90
2) 25, 25
5) 90, 90
4) 90, 10

Completely lacerated muscles recover 50% of their strength and 80% of their ability to shorten. Complete laceration is uncommon and is seen more often after trauma than after athletic accidents.Correct Answer: 50, 80

2948. (1597) Q7-1991:

Muscles at increased risk for injury include:

1) Muscles that cross a single joint and act concentrically.
3) Muscles that cross two joints and act concentrically.
2) Muscles that cross a single joint and act eccentrically.
5) Muscle injury is independent of the number of joints crossed and type of contraction.
4) Muscles that cross two joints and act eccentrically.

Muscles that cross two joints and that are acting in an eccentric fashion are at increased risk for injury. Frequently injured muscles also have a high percentage of type II (fast twitch) fibers.Correct Answer: Muscles that cross two joints and act eccentrically.

2949. (1598) Q7-1992:

Histology 7 days after muscle strain will most likely reveal:

1) Inflammatory reaction
3) Complete muscle regeneration
2) Fibrous tissue replacing the inflammatory reaction
5) Acute hemorrhage
4) No reaction

Inflammatory reaction is seen after 2 days. At 1 week, the inflammatory reaction is replaced by fibrous tissue, and some muscle regeneration may be evident. Muscle strains and tears heal through scarring with minimal replacement with normal muscle tissue.Correct Answer: Fibrous tissue replacing the inflammatory reaction

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2950. (1599) Q7-1993:

The initial treatment after a muscle strain includes:

1) Rest, heat, and elevation
3) Heat, rest, and aggressive stretching
2) Ice, rest, and aggressive stretching
5) Ice, rest, and elevation
4) Ice, elevation, and aggressive stretching

The usual initial treatment after a muscle strain involves rest, ice, compression, and elevation (RICE). Although gentle range of motion exercises can be instituted as tolerated, aggressive stretching may cause further hemorrhage and muscle injury.Correct Answer: Ice, rest, and elevation

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2951. (1600) Q7-1994:

Which of the following are important in prevention of muscle injury:

1) Improved muscle endurance
3) Minimal warm up
2) Inflexibility
5) Rapid muscle fatigue
4) Decreased muscle tone

Factors that decrease muscle injury include adequate warm up; a strong, flexible muscle; and improved muscle endurance. Fatigued muscles have diminished load to failure, total deformation, and energy to absorption prior to failure.Correct Answer: Improved muscle endurance

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2952. (1601) Q7-1995:

Fatigued muscles are characterized as having:

1) Lower propensity for injury
3) Diminished energy to absorption
2) Greater flexibility
5) Increased muscle tone
4) Less flexibility

Factors that decrease muscle injury include adequate warm up; a strong, flexible muscle; and improved muscle endurance. Fatigued muscles have diminished load to failure, total deformation, and energy to absorption prior to failure.Correct Answer: Diminished energy to absorption

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2953. (1602) Q7-1996:

Reported hamstring strength deficit by isokinetic testing after complete proximal rupture is approximately:

1) 10%
3) 60%
2) 20%
5) No deficit
4) 90%

In a series of 12 patients with complete or near complete proximal hamstring ruptures, the mean strength deficit measured 61% for the hamstring and 23% for the quadriceps musculature.Correct Answer: 60%

2954. (1603) Q7-1997:

Which of the following activities is associated with proximal hamstring ruptures:

1) High jumping
3) Water skiing
2) Skating
5) Basketball
4) Swimming

Water skiing is associated with proximal hamstring ruptures in both novice and experienced skiers. The mechanisms, however, are reported to be different depending on the level of skier. The novice skier typically sustains the injury while trying to get up on one or two skis from a submerged position, whereas the injury is typically the result of a fall in an experienced skier.Correct Answer: Water skiing

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2955. (1604) Q7-1998:

Patients with symptomatic chronic proximal hamstring ruptures typically complain of:

1) Anterior thigh cramping with running
3) Difficulty ascending stairs
2) Difficulty decelerating the leg during running
5) Difficulty accelerating the leg during running
4) Difficulty descending stairs

Patients typically complain of a pulling sensation or cramping in the posterior thigh with vigorous activity. In addition, they may describe difficulty controlling the leg, which has been attributed to the impaired deceleration of the thigh as a result of the complete rupture.Correct Answer: Difficulty decelerating the leg during running

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2956. (1605) Q7-1999:

The recommended treatment of a complete proximal hamstring rupture with 4-cm retraction in a young athletic adult is:

1) Nonoperative rehabilitation
3) Surgical reattachment of the proximal hamstrings
2) Nonoperative rehabilitation followed by surgical repair if there is continued disability
5) Complete proximal hamstring ruptures have not been reported
4) No rehabilitation or surgery is indicated

Patients with disability secondary to chronic complete proximal hamstring ruptures have been increasingly identified. Because of the reports of continued weakness and poor leg control, more authors are recommending acute repair of these injuries. Chronic repairs are reported to be much more difficult although good results are reported.Correct Answer: Surgical reattachment of the proximal hamstrings

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2957. (1606) Q7-2000:

When comparing operative to nonoperative treatment of Achilles tendon ruptures, the major difference in outcome reported in the literature is:

1) Return to full activity
3) Rerupture rate
2) Plantarflexion strength
5) There are no reported differences in results.
4) Ultimate range of motion

In a review of the literature, the rerupture rate after nonoperatively treated Achilles tendon ruptures was 13.4% compared to 1.4% for operative treatment. A prospective randomized study also substantiated these findings. Although the number of patients returning to full sporting activity and plantarflexion strength measurements was higher in the operative group, the differences were not as marked as the rerupture rate.Correct Answer: Rerupture rate

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2958. (1607) Q7-2001:

Histology of chronic Achilles tendinosis DOES NOT reveal which of the following:

1) Abnormal fiber structure
3) Vascular proliferation
2) Focal hypercellularity
5) All of the above are noted
4) Abundant inflammatory cells

Histological analysis of Achilles tedinosis has revealed abnormal fiber structure, focal hypercellularity, and vascular proliferation. Inflammatory cells are not present in patients with chronic Achilles tendinosis.Correct Answer: Abundant inflammatory cells

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2959. (1608) Q7-2002:

Initial management of a symptomatic Haglundâs deformity in a runner consists of:

1) Intratendinous steroid injection
3) Excision of the posterosuperior calcaneal prominence
2) Debridement of the tendon
5) A firm heel counter and medial heel wedge
4) Heel lift and soft shoe counter

Haglundâs deformity is characterized by a prominence about the posterosuperior calcaneus that can lead to retrocalcaneal bursitis and Achilles tendon injury just proximal to its insertion. The initial treatment involves relieving pressure from the affected area with a heel lift and soft heel counter. Resistant cases may benefit from excision of the prominence and debridement of the bursa and tendon.Correct Answer: Heel lift and soft shoe counter

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2960. (1609) Q7-2003:

Which of the following is not consistent with a complete rupture of the Achilles tendon:

1) A palpable defect 3 cm to 4 cm proximal to the Achilles insertion
3) Sensation of being kicked in the calf
2) Ability to plantarflex the foot against gravity
5) No previous symptoms of Achilles related pain
4) Plantarflexion of the foot with the Thompson test

Patients who sustain an Achilles tendon rupture will often feel as if they were kicked in the back of the leg. They experience the sudden onset of pain and may present with a palpable defect. The patients may note plantarflexion weakness but may demonstrate active plantarflexion of the foot as a result of other muscles that cross posterior to the ankle such as the flexor hallucis longus and tibialis posterior muscles. The Thompson test (midcalf squeeze) will typically illicit no plantarflexion of the foot.Correct Answer: Plantarflexion of the foot with the Thompson test

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2961. (1610) Q7-2004:

The primary collagen type found in the knee meniscus is:

1) Type I
3) Type III
2) Type II
5) Type VI
4) Type V

Type I collagen makes up 90% of the collagen in the meniscus. The remainder is made up of types II, III, V, and VI collagen. Type II makes up the majority of collagen in articular cartilage.Correct Answer: Type I

2962. (1611) Q7-2005:

The transverse intermensical ligament is occasionally the only site of attachment for the:

1) Anterior horn lateral meniscus
3) Posterior horn lateral meniscus
2) Anterior horn medial meniscus
5) None of the above
4) Posterior horn medial meniscus

Although the majority of the time the anterior horn of the medial meniscus has a firm bony attachment, the transverse intermeniscal ligament is the only site of anterior attachment in 3% to 14% of cases.Correct Answer: Anterior horn medial meniscus

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2963. (1612) Q7-2006:

With regard to the meniscofemoral ligaments, the ligament of Humphrey runs ___ to the posterior cruciate ligament (PCL) and the ligament of Wrisberg runs _____ to the PCL.

1) Posterior, anterior
3) Anterior, anterior
2) Anterior, posterior
5) Medial, lateral
4) Posterior, posterior

The anterior meniscofemoral ligament of Humphrey runs from the femur to the posterior horn of the lateral meniscus anterior to the PCL. The ligament of Wrisberg runs posterior to the PCL. It is occasionally the only posterior horn attachment site for a discoid lateral meniscus and can result in excessive motion and posterior horn instability.Correct Answer: Anterior, posterior

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2964. (1613) Q7-2007:

The ligament that has an association with an unstable lateral discoid meniscus is:

1) Ligament of Humphrey
3) Lateral collateral ligament
2) Medial collateral ligament
5) Anterior cruciate ligament
4) Ligament of Wrisberg

The anterior meniscofemoral ligament of Humphrey runs from the femur to the posterior horn of the lateral meniscus anterior to the posterior cruciate ligament (PCL). The ligament of Wrisberg runs posterior to the PCL. It is occasionally the only posterior horn attachment site for a discoid lateral meniscus and can result in excessive motion and posterior horn instability. The medial and lateral collateral ligaments are not the attachment sites for the posterior horn of some lateral discoid meniscal variants.Correct Answer: Ligament of Wrisberg

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2965. (1614) Q7-2008:

Vascularity of the adult meniscus is limited to the:

1) Inner 10% to 30%
3) Peripheral 10% to 30%
2) Inner 30% to 50%
5) Entire meniscus is vascular
4) Peripheral 30% to 50%

Studies show that only the peripheral 10% to 25% of the lateral meniscus and 10% to 30% of the medial meniscus is vascular. The vascularity arises from the medial and lateral genicular arteries.Correct Answer: Peripheral 10% to 30%

2966. (1615) Q7-2009:

The most important structure that resists anterior tibial translation in the anterior cruciate ligament (ACL)-deficient knee is the:

1) Anterior horn medial meniscus
3) Posterior horn medial meniscus
2) Anterior horn lateral meniscus
5) Lateral collateral ligament
4) Posterior horn lateral meniscus

One study evaluated the role of the meniscus in anteroposterior stability of the ACL-deficient knee. The researchers found that the posterior horn of the medial meniscus was the most important structure resisting an applied anterior tibial force in an ACL-deficient knee. The peripheral portion of the meniscus is essential for both load transmission and stability.Correct Answer: Posterior horn medial meniscus

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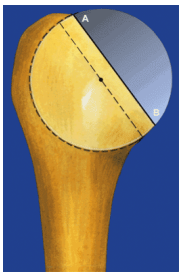
2967. (1874) Q7-2279:

Approximately what percentage of middle-aged tennis players are able to return to tennis after rotator cuff surgery:

1) 20%
3) 60%
2) 40%
5) 100%
4) 80%

In a series evaluating the results of surgical treatment of rotator cuff tears in 51 middle-aged tennis players, Sonnery-Cottet and colleagues discovered that approximately 80% of patients returned to tennis at latest follow-up.Correct Answer: 80%

2968. (1875) Q7-2281:



Slide 1

Proximal humeral anatomy is variable. Which of the following measurements most accurately describe the range of diameters of the humeral head (length of line AB):

1) 25 mm to 35 mm
3) 45 mm to 55 mm
2) 35 mm to 45 mm
5) 35 mm to 55 mm
4) 25 mm to 45 mm

Proximal humeral anatomy is variable. The high variability is the basis for radical changes in design of shoulder arthroplasty. The diameter of the humeral head ranges from approximately 35 mm to 55 mm.Correct Answer: 35 mm to 55 mm

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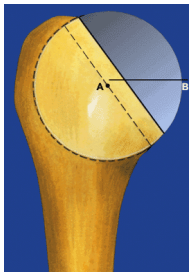
2969. (1876) Q7-2283:

Which of the following statements best describes the relationship of humeral head diameter to humeral head thickness:

1) Humeral head diameter and humeral head thickness are independent of one another.
3) Humeral head diameter and humeral head thickness have an inversely proportional linear relationship.
2) Humeral head diameter and humeral head thickness have a directly proportional linear relationship.
5) Humeral head diameter and humeral head thickness have an inversely proportional logarithmic relationship.
4) Humeral head diameter and humeral head thickness have a directly proportional logarithmic relationship.

Humeral head diameter and humeral head thickness have a directly proportional linear relationship.Correct Answer: Humeral head diameter and humeral head thickness have a directly proportional linear relationship.

2970. (1877) Q7-2284:



Slide 1

Proximal humeral anatomy is variable. Which of the following measurements most accurately describe the range of radius of curvature of the humeral head (length of line AB):

1) 5 mm to 10 mm
3) 15 mm to 20 mm
2) 10 mm to 15 mm
5) 30 mm to 40 mm
4) 20 mm to 30 mm

Proximal humeral anatomy is variable. This high variability is the basis for radical changes in design of shoulder arthroplasty. The humeral head radius of curvature ranges from approximately 20 mm to 30 mm.Correct Answer: 20 mm to 30 mm

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2971. (1878) Q7-2286:

The proximal humeral articular surface can be described as a portion of a sphere. The center of this sphere has which of the following anatomic relationships to the long axis of the humerus:

1) The center of this sphere lies on the long axis of the humerus.
3) The center of this sphere is offset posteriorly with respect to the long axis of the humerus.
2) The center of this sphere is offset medially with respect to the long axis of the humerus.
5) The center of this sphere is offset medially and posteriorly with respect to the long axis of the humerus.
4) The center of this sphere is offset anteriorly with respect to the long axis of the humerus.

Anatomically, a sphere can be fit to the proximal humerus with the articular surface comprising a portion of that spher The center of this sphere is offset 3 mm to 11 mm medially and 1 mm to 6 mm posteriorly with respect to the long axis of the humerus.Correct Answer: The center of this sphere is offset medially and posteriorly with respect to the long axis of the humerus.

2972. (1879) Q7-2287:

Which of the following pitch types is associated with the development of shoulder pain in baseball pitchers between the ages of 9 and 14 years:

1) Fastball
3) Curveball
2) Change-up
5) Knuckle ball
4) Slider

A study following 476 young baseball pitchers for one season demonstrated that the use of the curveball in this age group was associated with a 52% increased risk of the development of shoulder pain.Correct Answer: Curveball

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2973. (1880) Q7-2288:

Which of the following pitch types is associated with the development of elbow pain in baseball pitchers between the ages of 9 and 14 years:

1) Fastball
3) Curveball
2) Change-up
5) Knuckle ball
4) Slider

A study following 476 young baseball pitchers for one season demonstrated that use of the slider in this age group was associated with an 86% increased risk of the development of elbow pain.Correct Answer: Slider

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2974. (1881) Q7-2289:

It is recommended to limit youth baseball pitchers (9 to 14 years of age) to how many pitches per game

1) 25
3) 75
2) 50
5) 125
4) 100

In young baseball pitchers, high pitch counts are associated with increased risk of shoulder pain. Based on a study of 476 youth baseball pitchers, it is recommended to limit pitch counts to 75 pitches per gamCorrect Answer: 75

2975. (1882) Q7-2290:

It is recommended to limit youth baseball pitchers (9 to 14 years of age) to how many game situation pitches per baseball season:

1) 200
3) 600
2) 400
5) 1000
4) 800

In young baseball pitchers, high pitch counts are associated with increased risk of shoulder pain. Based on a study of 476 youth baseball pitchers, it is recommended to limit pitch counts to 600 game situation pitches per season.Correct Answer: 600

2976. (1883) Q7-2292:

Which of the following statements is true regarding traumatic anterior shoulder instability:

1) Abnormal glenohumeral translation occurs mainly in the provocative position of 90Â° abduction and external rotation, and this translation is corrected by contraction of the dynamic shoulder stabilizers.
3) Abnormal glenohumeral translation occurs mainly in the provocative position of 90Â° abduction and external rotation, and this translation is not corrected by contraction of the dynamic shoulder stabilizers.
2) Abnormal glenohumeral translation occurs in multiple arm positions, and this translation is corrected by contraction of the dynamic shoulder stabilizers.
5) No abnormal glenohumeral translation occurs in traumatic shoulder instability.
4) Abnormal glenohumeral translation occurs in multiple arm positions, and this translation is not corrected by contraction of the dynamic shoulder stabilizers.

A study evaluating glenohumeral translation and muscle activity related traumatic and atraumatic shoulder instability demonstrated that patients with traumatic shoulder instability have abnormal glenohumeral translation mainly in the provocative position of 90Â° abduction and external rotation. This translation is corrected by contraction of the dynamic shoulder stabilizers.Correct Answer: Abnormal glenohumeral translation occurs mainly in the provocative position of 90Â° abduction and external rotation, and this translation is corrected by contraction of the dynamic shoulder stabilizers.

2977. (1884) Q7-2293:

Which of the following is the most common radiographic finding in patients with lateral epicondylitis:

1) Soft tissue calcification at the lateral aspect of the elbow
3) Olecranon osteophyte
2) Coronoid osteophyte
5) Osteochondritis dessicans
4) Intraosseous cyst

In a radiographic analysis of 294 patients with lateral epicondylitis, 20 patients had lateral soft tissue calcification, 14 patients had coronoid osteophytes, nine patients had olecranon osteophytes, two patients had intraosseous cysts, and two patients had osteochondritis dessicans. The author concluded that routine radiography is not warranted in the initial management of lateral epicondylitis.Correct Answer: Soft tissue calcification at the lateral aspect of the elbow

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2978. (1885) Q7-2294:

A 32-year-old male recreational tennis player presents with a 4-week history of progressive activity-related elbow pain in his dominant upper extremity. Clinical examination demonstrates marked tenderness at the lateral epicondyle and pain at the lateral epicondyle with resisted wrist extension. No instability is detected on clinical examination. The next step in management is:

1) Routine radiography
3) Activity modification, nonsteroidal anti-inflammatory agents, and physical therapy
2) Magnetic resonance imaging
5) Arthroscopic surgical excision of pathological tissue
4) Open surgical excision of pathological tissue

This patient has lateral epicondylitis. A recent radiographic analysis of lateral epicondylitis showed that radiographs taken at initial presentation did not alter the initial management. Most patients with lateral epicondylitis respond to nonoperative treatment. Surgical treatment should only be considered after failure of a prolonged course (at least 6 months) of nonoperative treatment.Correct Answer: Activity modification, nonsteroidal anti-inflammatory agents, and physical therapy

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2979. (1886) Q7-2295:

During diagnostic elbow arthroscopy, which of the following nerves is at the greatest risk for injury:

1) Ulnar nerve
3) Radial nerve
2) Median nerve
5) Anterior interosseous nerve
4) Posterior interosseous nerve

The radial nerve is at the greatest risk for injury during elbow arthroscopy. Injury usually occurs during creation of the anterolateral portal.Correct Answer: Radial nerve

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2980. (1887) Q7-2296:

Which of the following elbow arthroscopic portals is correctly matched to the nerve at risk during portal creation:

1) Anteromedial portal â ulnar nerve
3) Posterior portal â ulnar nerve
2) Anteromedial portal â radial nerve
5) Posterior portal â radial nerve
4) Anterolateral portal â median nerve

Incorrect placement of the anterolateral portal places the radial nerve at risk. Incorrect placement of the anteromedial portal places the median and ulnar nerves at risk. The posterior portal is not associated with neural injury.Correct Answer: Anteromedial portal â ulnar nerve

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2981. (1888) Q7-2297:

Which of the following statements is true regarding the use of a two-incision technique vs a single-incision technique for distal biceps repair:

1) The two-incision technique is associated with increased risk of neural injury, while the single-incision technique is associated with an increased risk of heterotopic ossification.
3) The two-incision technique is associated with increased risk of neural injury, while the risk of heterotopic ossification is the same for both procedures.
2) The two-incision technique is associated with increased risk of heterotopic ossification, while the single-incision technique is associated with an increased risk of nerve injury.
5) The risk of nerve injury and heterotopic ossification is the same for both procedures.
4) The two-incision technique is associated with increased risk of heterotopic ossification, while the risk of nerve injury is the same for both procedures.

Successful treatment of distal biceps tendon tears include dual- and single-incision techniques. The two-incision technique is associated with increased risk of heterotopic ossification, whereas the single-incision technique is associated with an increased risk of nerve injury.Correct Answer: The two-incision technique is associated with increased risk of heterotopic ossification, while the single-incision technique is associated with an increased risk of nerve injury.

2982. (1889) Q7-2298:

Approximately what percentage of supination strength is lost with an unrepaired distal biceps tendon rupture:

1) 5%
3) 40%
2) 20%
5) 80%
4) 60%

The biceps provides approximately 40% of supination strength to the forearm.Correct Answer: 40%

2983. (1890) Q7-2299:

The anterior cruciate ligament is composed of which of the following bundles:

1) Anterolateral, posteromedial
3) Mediolateral, posteromedial
2) Anteromedial, posterolateral
5) Medial, lateral
4) Anterior, posterior

The anterior cruciate ligament consists of two bundles. The anteromedial bundle is tight in flexion, and the posterolateral bundle is tight in extension.Correct Answer: Anteromedial, posterolateral

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2984. (1891) Q7-2300:

The anterior cruciate ligament (ACL) provides what percent of the stability to anterior tibial translation with the knee flexed 30Â °:

1) 10%
3) 50%
2) 25%
5) 85%
4) 65%

The ACL functions as the primary stabilizer to anterior tibial translation providing more than 85% of stability with the knee in 30Â° of flexion.Correct Answer: 85%

2985. (1892) Q7-2301:

Which of the following positions of knee flexion produces the greatest strain in the anterior cruciate ligament with anterior loading of the tibia:

1) 30Â° (Lachman test)
3) 55Â°
2) 45Â°
5) 90Â° (anterior drawer test)
4) 75Â°

Clinical and biomechanical studies show that anterior loading of the tibia in 30Â° of knee flexion produces greater strain and elongation of the normal anteromedial bundle than loading in 90Â° of knee flexion.Correct Answer: 30Â° (Lachman test)

2986. (1893) Q7-2302:

Anterior cruciate ligament (ACL) injuries are almost _____ in women than in their male counterparts in collegiate basketball players:

1) Four times less common
3) Eight times more common
2) One and a half times more common
5) Half as common
4) Equal in prevalence

Female collegiate basketball players are almost eight times as likely to sustain ACL injuries as their male counterparts.Correct Answer: Eight times more common

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2987. (1894) Q7-2303:

Which of the following is not considered an intrinsic risk factor for anterior cruciate ligament (ACL) injury:

1) Narrow notch width index
3) All of the above
2) Altered neuromuscular control
5) Male gender
4) Increased laxity

Intrinsic risk factors for ACL injury include a narrow notch width index, a weak or small native ACL, knee joint anteroposterior laxity, malalignment of the lower extremity, pelvic position, navicular drop, and subtalar joint pronation. Male gender is not a risk factor for ACL injury.Correct Answer: Male gender

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2988. (1895) Q7-2304:

Anterior cruciate ligament (ACL) injury is most commonly the result of:

1) A valgus load as a result of contact
3) A varus load as a result of contact
2) A hyperextension as a result of contact
5) Penetrating trauma
4) A noncontact injury

An ACL injury is commonly the result of a noncontact mechanism. Two common mechanisms that have been described include a valgus force to a flexed knee with the leg in external rotation and knee hyperextension with the leg internally rotated.Correct Answer: A noncontact injury

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2989. (1896) Q7-2305:

The incidence of meniscal injury with a concomitant ACL tear is reported to be nearly _____, with the _____ meniscus more commonly injured in the acute setting:

1) 30%, medial
3) 30%, lateral
2) 70%, medial
5) 70%, lateral
4) 50%, lateral

The incidence of meniscal tear after acute anterior cruciate ligament (ACL) injury is reported to be approximately 70%. The lateral meniscus is more often injured in the acute setting, and the medial meniscus is more often injured in the chronically ACL-deficient kneCorrect Answer: 70%, lateral

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2990. (1897) Q7-2306:

The healing rate of meniscal repairs in association with acute anterior cruciate ligament (ACL) reconstruction is_____ that reported for isolated meniscal repairs:

1) Higher than
3) Equal to
2) Lower than
5) Unknown
4) Meniscal repairs are not recommended in this situation

The results with respect to healing of meniscal repairs in the association of an acute ACL injury are reported to be better than in other situations (92% vs 67%).Correct Answer: Higher than

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2991. (1898) Q7-2307:

The typical locations for bone contusions as viewed on magnetic resonance imaging after anterior cruciate ligament (ACL) injury are the:

1) Medial femoral condyle and medial tibial plateau
3) Middle third of the lateral femoral condyle and posterolateral tibia
2) Anterior third of the lateral femoral condyle and posterolateral tibia
5) Patellofemoral compartment
4) Posterior third of the lateral femoral condyle and posterolateral tibia

The typical locations for bone contusions after an ACL injury are the middle third of the lateral femoral condyle and the posterolateral tibia.Correct Answer: Middle third of the lateral femoral condyle and posterolateral tibia

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2992. (1899) Q7-2308:

The sensitivity of the Lachman test is reported to be up to:

1) 30%
3) 78%
2) 55%
5) 98%
4) 85%

Physical examination of the knee includes performing a Lachman test, which has a reported sensitivity of up to 98%.Correct Answer: 98%

2993. (1900) Q7-2309:

The optimal timing for performing anterior cruciate ligament reconstruction after an acute injury is:

1) Within 24 hours
3) After 4 to 6 weeks
2) Within the first 3 weeks
5) Timing has not been shown to effect outcomes
4) After return of full knee range of motion

Shelbourne noted a decrease in the incidence of postoperative stiffness to less than 1% and faster return of strength when surgery is performed after obtaining full knee range of motion including hyperextension of the knee.Correct Answer: After return of full knee range of motion

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2994. (1901) Q7-2310:

The most common technical errors when performing anterior cruciate ligament reconstruction are:

1) Excessively anterior tunnels
3) Iatrogenic posterior cruciate ligament injury
2) Intraoperative fracture
5) Excessively medial tunnels
4) Excessively posterior tunnels

The most common technical errors involve excessively anterior placement of the tunnels. Anterior tibial tunnel and femoral tunnel placement can result in graft impingement, inability to fully extend the knee, and eventual failure. Excessively anterior femoral tunnel placement can also result in capturing the knee with difficulty in gaining full flexion and eventual stretching or rupture of the graft with attempts at gaining full flexion.Correct Answer: Excessively anterior tunnels

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2995. (1902) Q7-2311:

All of the following is used to identify the appropriate position for anterior cruciate ligament (ACL) tibial tunnel placement except:

1) Inner rim of the anterior horn and lateral meniscus
3) Medial tibial spine
2) 7 mm anterior to the posterior cruciate ligament (PCL)
5) Inner rim of the anterior horn of the medial meniscus
4) ACL stump/footprint

Tibial tunnel misplacement can be avoided by using the appropriate landmarks (inner rim of the anterior horn of the lateral meniscus, referencing off of the PCL, the medial tibial spine, and the ACL stump).Correct Answer: Inner rim of the anterior horn of the medial meniscus

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2996. (1903) Q7-2312:

Adequate bone plug length for interference screw fixation during bone-tendon-bone anterior cruciate ligament reconstruction is:

1) At least 5 mm in length
3) At least 15 mm in length
2) At least 10 mm in length
5) Bone plug length is not related to fixation strength.
4) No less than 20 mm in length

Graft fixation is the weak point in the early postoperative period. Researchers have reported that the optimal bone plug length is at least 1 cm. Bone plugs of shorter lengths have decreased peak load to failure, but bone plugs of greater length did not have significantly increased peak loads to failure.Correct Answer: At least 10 mm in length

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2997. (1904) Q7-2313:

Anterior knee pain was noted in all of the following situations except:

1) Anterior cruciate ligament (ACL) reconstruction with bone-tendon-bone autograft
3) After nonoperative treatment of the ACL injury
2) ACL reconstruction with hamstrings
5) Following acute patellar dislocation
4) In meniscal tears treated nonoperatively

Anterior knee pain was reported after patellar tendon and hamstring ACL reconstruction. Although some reports show increased pain with kneeling after patellar tendon ACL reconstruction, it is important to note the development of anterior knee pain in patients with ACL injuries treated nonoperatively. Anterior knee pain after ACL injury with or without reconstruction is not well understood and is likely multifactorial in nature.Correct Answer: In meniscal tears treated nonoperatively

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2998. (1905) Q7-2314:

Accelerated rehabilitation after anterior cruciate ligament reconstruction has resulted in:

1) Increased graft failure rates
3) Increased rates of stiffness
2) Decreased time to full activity
5) Increased meniscal tears
4) Prolonged time to full activity

Accelerated rehabilitation focusing on gaining and maintaining full extension, early unrestricted range of motion, and progression of rehabilitation based on achieving functional goals rather than a strict timeline has resulted in earlier return to sporting activities without compromising the ultimate result.Correct Answer: Decreased time to full activity

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2999. (1906) Q7-2315:

Strain in the anterior talofibular ligament (ATFL) _____ as the ankle moves from dorsiflexion to plantarflexion.

1) Increases
3) Remains unchanged
2) Decreases
5) Increases initially then decreases
4) Has not been evaluated

The ATFL primarily functions to restrict internal rotation of the talus in the mortis Strain in the ATFL increases as the ankle moves from dorsiflexion and plantarflexion, and it is the primary restraint to anterior translation and adduction in this position.Correct Answer: Increases

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3000. (1907) Q7-2316:

The most commonly injured ligament after inversion ankle sprains is the:

1) Anterior tibiofibular ligament
3) Anterior talofibular ligament
2) Calcaneofibular ligament
5) Deltoid ligament
4) Posterior talofibular ligament

Isolated anterior talofibular ligament (ATFL) injuries are reported to occur in 67% of ankle sprains. The anterior talofibular ligament is the most commonly injured ligament after inversion ankle sprains.Correct Answer: Anterior talofibular ligament

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3001. (1908) Q7-2317:

The recommended treatment for grade 1 and 2 lateral ankle sprains includes:

1) Cast immobilization
3) Functional bracing
2) Surgical repair and cast immobilization
5) Surgical reconstruction with peroneal tendon transfer
4) Surgical repair and functional bracing

Although some authors have recommended surgical treatment of acute grade III (unstable) ankle sprains, recent studies have reported less pain, decreased atrophy, earlier return to sport, and no increased incidence of late instabilities with nonsurgical treatment (functional bracing) compared to surgical treatment. In studies comparing cast immobilization and functional bracing, patients in the functional bracing group return to sporting activities significantly earlier than the cast group without compromising mechanical stability.Correct Answer: Functional bracing

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3002. (1909) Q7-2318:

Associated lesions in the presence of chronic lateral ankle instability include all of the following except:

1) Peroneal tenosynovitis
3) Anterolateral impingement lesion
2) Talar osteochondritis dissecans (OCD) lesions
5) Plantar fascitis
4) Loose bodies

One study evaluating chronic lateral ankle instability found the following associated lesions: peroneal tenosynovitis (77%), anterolateral impingement lesion (67%), attenuated peroneal retinaculum (54%), ankle synovitis (49%), loose bodies (26%), talar OCD (23%), medial ankle tendon tenosynovitis (5%).Correct Answer: Plantar fascitis

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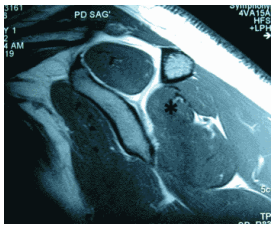
3003. (2038) Q7-2454:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. Identify the structure marked by the asterisk.

1) Subscapularis muscle
3) Infraspinatus muscle
2) Biceps muscle
5) Trapezius muscle
4) Deltoid muscle

The asterisk marks the infraspinatus muscle.Correct Answer: Infraspinatus muscle

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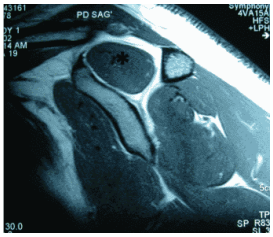
3004. (2039) Q7-2456:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. Identify the structure marked by the asterisk.

1) Subscapularis muscle
3) Biceps muscle
2) Trapezius muscle
5) Deltoid muscle
4) Supraspinatus muscle

The asterisk marks the supraspinatus muscle.Correct Answer: Supraspinatus muscle

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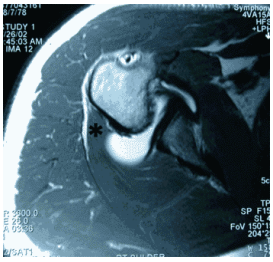
3005. (2040) Q7-2458:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. Identify the structure marked by the asterisk.

1) Teres minor muscle
3) Triceps muscle
2) Teres major muscle
5) Deltoid muscle
4) Infraspinatus muscle

The asterisk marks the teres minor muscle.Correct Answer: Teres minor muscle

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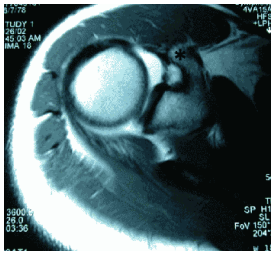
3006. (2041) Q7-2459:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. All of the following structures have an attachment to the structure marked by the asterisk except:

1) Coracobrachialis
3) Biceps brachii
2) Coracoacromial ligament
5) Pectoralis major
4) Pectoralis minor

The asterisk marks the coracoid process. All of the listed structures have a coracoid attachment except the pectoralis major.Correct Answer: Pectoralis major

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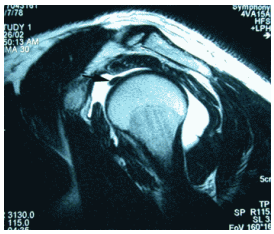
3007. (2042) Q7-2460:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. Identify the structure marked by the arrow.

1) Superior glenohumeral ligament
3) Long head of the biceps tendon
2) Middle glenohumeral ligament
5) Coracohumeral ligament
4) Short head of the biceps tendon

The arrow marks the long head of the biceps tendon.Correct Answer: Long head of the biceps tendon

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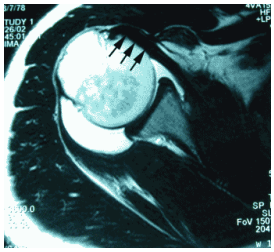
3008. (2043) Q7-2461:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. Identify the structure marked by the arrows.

1) Subscapularis tendon
3) Long head of the biceps tendon
2) Supraspinatus tendon
5) Coracohumeral ligament
4) Short head of the biceps tendon

The arrows mark the subscapularis tendon.Correct Answer: Subscapularis tendon

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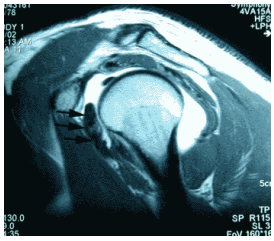
3009. (2044) Q7-2462:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. Identify the structure marked by the arrows.

1) Subscapularis tendon
3) Long head of the biceps tendon
2) Supraspinatus tendon
5) Coracohumeral ligament
4) Short head of the biceps tendon

The arrows mark the subscapularis tendon.Correct Answer: Subscapularis tendon

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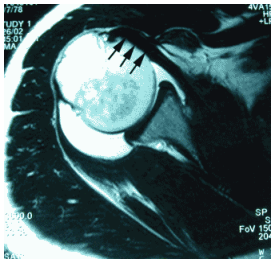
3010. (2045) Q7-2463:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. The structure marked by the arrows is innervated by which of the following structures:

1) Musculocutaneous nerve
3) Branch of the lateral cord of the brachial plexus
2) Branch of the posterior cord of the brachial plexus
5) Branch of the superior trunk of the brachial plexus
4) Branch of the medial cord of the brachial plexus

The arrows mark the subscapularis tendon. The subscapularis muscle is innervated by the upper and lower subscapular nerves. The upper and lower subscapular nerves are branches from the posterior cord of the brachial plexus.Correct Answer: Branch of the posterior cord of the brachial plexus

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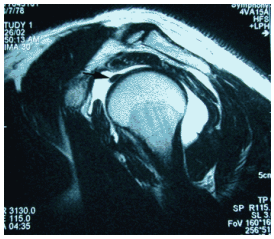
3011. (2046) Q7-2464:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. The structure marked by the arrow is innervated by which of the following structures:

1) Musculocutaneous nerve
3) Branch of the lateral cord of the brachial plexus
2) Branch of the posterior cord of the brachial plexus
5) Branch of the superior trunk of the brachial plexus
4) Branch of the medial cord of the brachial plexus

The arrow marks the long head of the biceps tendon. The biceps muscle is innervated by the musculocutaneous nerve.Correct Answer: Musculocutaneous nerve

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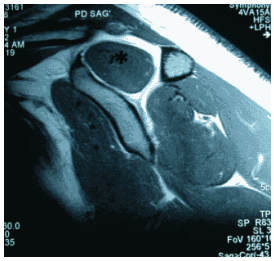
3012. (2047) Q7-2465:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. The structure marked by the asterisk is innervated by which of the following structures:

1) Musculocutaneous nerve
3) Branch of the lateral cord of the brachial plexus
2) Branch of the posterior cord of the brachial plexus
5) Branch of the superior trunk of the brachial plexus
4) Branch of the medial cord of the brachial plexus

The asterisk marks the supraspinatus muscle. The supraspinatus muscle is innervated by the suprascapular nerve. The suprascapular nerve is a branch from the superior trunk of the brachial plexus.Correct Answer: Branch of the superior trunk of the brachial plexus

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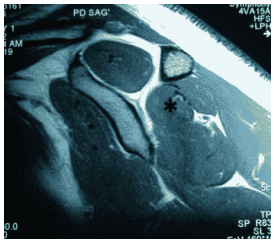
3013. (2048) Q7-2466:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. The structure marked by the asterisk is innervated by which of the following structures:

1) Musculocutaneous nerve
3) Branch of the lateral cord of the brachial plexus
2) Branch of the posterior cord of the brachial plexus
5) Branch of the superior trunk of the brachial plexus
4) Branch of the medial cord of the brachial plexus

The asterisk marks the infraspinatus muscle. The infraspinatus muscle is innervated by the suprascapular nerve. The suprascapular nerve is a branch from the superior trunk of the brachial plexus.Correct Answer: Branch of the superior trunk of the brachial plexus

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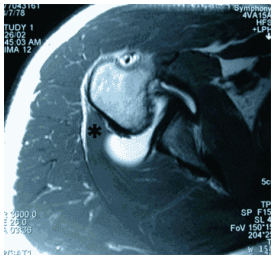
3014. (2049) Q7-2467:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. The structure marked by the asterisk is innervated by which of the following structures:

1) Musculocutaneous nerve
3) Branch of the lateral cord of the brachial plexus
2) Branch of the posterior cord of the brachial plexus
5) Branch of the superior trunk of the brachial plexus
4) Branch of the medial cord of the brachial plexus

The asterisk marks the teres minor muscle.The teres minor muscle is innervated by the axillary nerve. The axillary nerve is a terminal branch from the posterior cord of the brachial plexus.Correct Answer: Branch of the posterior cord of the brachial plexus

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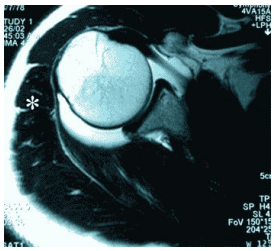
3015. (2050) Q7-2468:



Slide 1

A magnetic resonance image of a patientâs right shoulder is shown. The structure marked by the asterisk is innervated by which of the following structures:

1) Musculocutaneous nerve
3) Branch of the lateral cord of the brachial plexus
2) Branch of the posterior cord of the brachial plexus
5) Branch of the superior trunk of the brachial plexus
4) Branch of the medial cord of the brachial plexus

The asterisk marks the deltoid muscle. The deltoid muscle is innervated by the axillary nerve. The axillary nerve is a terminal branch from the posterior cord of the brachial plexus.Correct Answer: Branch of the posterior cord of the brachial plexus

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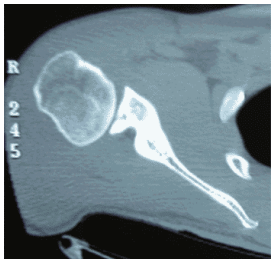
3016. (2051) Q7-2469:



Slide 1

A 40-year-old athletic man with no history of traumatic injury and progressive shoulder pain over the past 2 years comes into your clinic for examination. He has had no previous surgery. A computed tomography scan of his shoulder is performed. Which of the following is the most likely scenario:

1) Gradual resolution of the symptoms without further treatment
3) Recurrent posterior glenohumeral dislocations/subluxations
2) Recurrent anterior glenohumeral dislocations/subluxations
5) Development of glenohumeral arthritis
4) Development of rotator cuff tear arthropathy

This patient has static posterior subluxation of the humeral head. Walch and colleagues described this entity as most likely being the first stage in the development of primary glenohumeral osteoarthritis. In this particular case, the patient already has thinning of the articular cartilage posteriorly.Correct Answer: Development of glenohumeral arthritis

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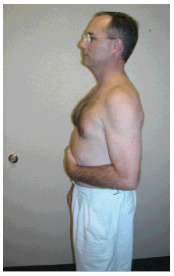
3017. (2052) Q7-2470:



Slide 1

This clinical photograph (Slide) depicts the examination of a 41-year-old man. What is the structure or clinical findings being tested

1) Anterior shoulder instability
3) Multidirectional shoulder instability
2) Posterior shoulder instability
5) Biceps tendon rupture
4) Subscapularis tendon tear

This patient exhibits a positive "belly press" test. As he attempts to press on his abdomen, his wrist goes into flexion and his arm goes into extension because of subscapularis insufficiency.Correct Answer: Subscapularis tendon tear

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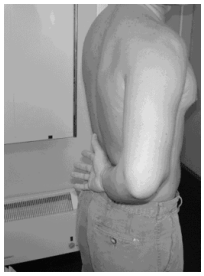
3018. (2053) Q7-2471:



Slide 1

This clinical picture (Slide) depicts the examination of a 28-year-old man as he tries to lift his hand away from his lumbar spin What structure or clinical entity is being tested?

1) Anterior shoulder instability
3) Multidirectional shoulder instability
2) Posterior shoulder instability
5) Biceps tendon rupture
4) Subscapularis tendon tear

This patient exhibits a positive "lift-off" test. He lacks adequate internal rotation strength to lift his hand off of his back indicating subscapularis insufficiency.Correct Answer: Subscapularis tendon tear

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3019. (2054) Q7-2472:

A 21-year-old male distance runner has lateral sided knee pain when running. Running downhill makes the pain worse. He has minimal rest pain. He recalls no specific injury and denies any swelling. What is the most likely diagnosis:

1) Lateral meniscus tear
3) Iliotibial band friction syndrome
2) Lateral collateral ligament strain
5) Lateral hamstring tear
4) Plica

Iliotibial band friction syndrome is the most common cause of knee pain in runners. In the absence of trauma and swelling, iliotibial band friction syndrome is the most likely diagnosis in this patient.Correct Answer: Iliotibial band friction syndrome

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3020. (2055) Q7-2473:

A 21-year-old male distance runner has lateral sided knee pain when running. Pain increases when running downhill. He has minimal rest pain. He recalls no specific injury and denies any swelling. What is the most appropriate initial management:

1) Arthroscopic partial lateral menisectomy
3) Anterior cruciate ligament reconstruction
2) Lateral collateral ligament reconstruction
5) Activity modification, physical therapy, and anti-inflammatory medications
4) Iliotibial band release

Iliotibial band friction syndrome is the most common cause of knee pain in runners. In the absence of trauma and swelling, iliotibial band friction syndrome is the most likely diagnosis in this patient. Preferred initial treatment is nonoperative.Correct Answer: Activity modification, physical therapy, and anti-inflammatory medications

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3021. (2056) Q7-2474:

The major medial soft-tissue restraint that prevents lateral displacement of the patella is the:

1) Lateral patellofemoral ligament
3) Medial patellomeniscal ligament
2) Medial patellotibial ligament
5) Lateral patellotibial ligament
4) Medial patellofemoral ligament

The medial patellofemoral ligament (MPFL), which is in the second layer, is the major medial soft-tissue restraint that prevents lateral displacement of the patell The MPFL extends from the adductor tubercle to the superomedial border of the patell The medial patellomeniscal ligament and medial patellotibial ligament also contribute varying degrees of medial patellar restraint.Correct Answer: Medial patellofemoral ligament

---

3022. (2057) Q7-2476:

All of the following factors are associated with an increased risk of recurrent patellar dislocation except:

1) Excessive Q angle or lateralization of the tibial tubercle in relation to the trochlea
3) Patella alta
2) Excessive foot pronation or knee angular deformities
5) Male gender
4) Hypoplastic lateral femoral condyle

Multiple factors are associated with an increased risk of recurrent patellar dislocation. Excessive Q angle or lateralization of the tibial tubercle in relation to the trochlea, excessive foot pronation or knee angular deformities, patella alta, hypoplastic lateral femoral condyle, vastus medialis oblique dysplasia, and hyperlaxity have been reported to contribute to recurrent patellar dislocationCorrect Answer: Male gender

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3023. (2058) Q7-2477:

Studies show that recurrent patellar dislocation predominates in the:

1) Second decade of life
3) Fourth decade of life
2) Third decade of life
5) Sixth decade of life
4) Fifth decade of life

Studies show that recurrent patellar dislocation predominates in the second decade of life.Correct Answer: Second decade of life

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3024. (2059) Q7-2478:

Osteochondral lesions that involve the lateral femoral condyle and medial patella are noted in approximately what percentage of cases of patella dislocation:

1) 5%
3) 35%
2) 15%
5) 95%
4) 70%

Radiographic plain films are helpful to rule out osteochondral fractures of the medial patella or lateral femoral condyle. In one study, osteochondral lesions involving the lateral femoral condyle and medial patella were noted in 68% of cases.Correct Answer: 70%

3025. (2060) Q7-2479:

In the literature, the patella redislocation rate for conservatively treated patients ranges from:

1) 5% to 10%
3) 15% to 45%
2) 10% to 20%
5) 75% to 90%
4) 40% to 70%

The patella redislocation rate for conservatively treated patients ranges from 13% to 44% in the literature. The treatment varies from casting to an elastic bandage and early range of motion.Correct Answer: 15% to 45%

3026. (2061) Q7-2480:

Of patients treated surgically for patella dislocation, the recurrence rates range from:

1) 0% to 15%
3) 30% to 50%
2) 15% to 30%
5) 75% to 90%
4) 50% to 75%

Of patients treated surgically for patella dislocation, the recurrence rates range from 0% to 14%. The operative procedures have included medial patellofemoral ligament repair or reconstruction, medial reefing, lateral release, and tibial tubercle transfers. The optimal operative procedure remains controversial for first time dislocators. Patients must be evaluated on a case-by-case basis.Correct Answer: 0% to 15%

3027. (2062) Q7-2481:

After anteromedialization of the tibial tubercle, patients with which patellar lesions were found to have better outcomes:

1) Medial facet and distal lesions
3) Medial facet and proximal lesions
2) Lateral facet and distal lesions
5) Medial and lateral facet lesions
4) Lateral facet and proximal lesions

A study examining chondral lesions of the patella and anteromedialization of the tibial tubercle found that better results were obtained in patients with central or distal lesions and lateral facet chondral pathology than in patients with proximal patellar chondral or medial damage. The most effective treatment has been shown with lesions of the distolateral patella, and least efficacious when arthritic lesions are present throughout the patella or those that involve the trochlea. It has also been shown by contact pressures, that lesions of the proximal and medial patella could potentially fare the worst with an anteromedialization procedure since this procedure shifts the contact pressures preferentially to the proximal-medial patella postsurgically. The proximal-medial patellar lesions are not contraindications to the AMZ procedure, however.âCorrect Answer: Lateral facet and distal lesions

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3028. (2063) Q7-2482:

What percentage of patients with chronic exertional compartment syndrome report bilateral symptoms:

1) 10% to 20%
3) 40% to 55%
2) 30% to 45%
5) 100%
4) 75% to 95%

Up to 75% to 95% of patients with chronic exertional compartment syndrome report bilateral symptoms.Correct Answer: 75% to 95%

3029. (2064) Q7-2483:

The differential diagnosis for chronic exertional compartment syndrome includes all of the following except:

1) Tibial stress fracture
3) Popliteal artery entrapment
2) Medial tibial periostalgia
5) Femoral neck stress fracture
4) Fascial herniations

The differential diagnosis for chronic exertional compartment syndrome includes stress fractures, medial tibial periostalgia, tendinitis, nerve entrapment disorders, fascial herniations, vascular or neurogenic claudication, popliteal artery entrapment, and venous stasis.Correct Answer: Femoral neck stress fracture

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3030. (2065) Q7-2484:

The most commonly affected compartment in chronic exertional compartment syndrome is the:

1) Anterior compartment
3) Superficial posterior compartment
2) Lateral compartment
5) Medial compartment
4) Deep posterior compartment

The most commonly affected compartments in chronic exertional compartment syndrome are the anterior followed by the deep posterior, lateral, and rarely, the superficial posterior compartment. The medial compartment does not exist.Correct Answer: Anterior compartment

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3031. (2066) Q7-2485:

Slide 1

The appropriate treatment for a distance runner with leg pain (Slide) includes:

1) Intramedullary nailing
3) Continued running with orthotics
2) Bone grafting
5) No alteration in training
4) Keeping activities at a pain free level with return to full activity likely in 6 to 8 weeks

The magnetic resonance image shows a typical posteromedial tibial stress fractur This patient should have a period of relative rest with activities kept at a pain free level. A pneumatic leg brace was shown to result in an earlier return to full activity for posteromedial tibial stress fractures.Correct Answer: Keeping activities at a pain free level with return to full activity likely in 6 to 8 weeks

---

3032. (2067) Q7-2486:

The diagnosis of chronic exertional compartment syndrome is confirmed by measuring a resting pressure of more than ___mm Hg, 1-minute postexercise pressure of more than ___mm Hg, or a 5-minute postexercise pressure more than ___ mm Hg.

1) 10 mm Hg, 20 mm Hg, 15 mm Hg
3) 15 mm Hg, 30 mm Hg, 20 mm Hg
2) 30 mm Hg, 30 mm Hg, 30 mm Hg
5) 10 mm Hg, 10 mm Hg, 10 mm Hg
4) 5 mm Hg, 10 mm Hg, 5 mm Hg

Compartment pressure measurement and clinical history allow for an accurate diagnosis of chronic exertional compartment syndrome. The diagnosis is confirmed by measuring a resting pressure of more than 15 mm Hg, 1-minute postexercise pressure of more than 30 mm Hg, or a 5-minute postexercise pressure more than 20 mm Hg.Correct Answer: 15 mm Hg, 30 mm Hg, 20 mm Hg

---

3033. (2068) Q7-2487:

The recommended treatment for patients with chronic exertional compartment syndrome is:

1) Stretching and strengthening program
3) Fasciotomy
2) Activity modification
5) Steroid injections to reduce muscle swelling
4) Ultrasound

Unless patients are willing to avoid the offending activity, nonoperative management of chronic exertional compartment syndrome is unsuccessful. The surgical management involves fasciotomy of the affected compartments.Correct Answer: Fasciotomy

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3034. (2069) Q7-2489:

Generally, the results after fasciotomy in carefully selected patients with acute compartment syndrome have resulted in improvement of symptoms in what percentage of patients:

1) 10% to 20%
3) 50% to 70%
2) 25% to 50%
5) 100%
4) 80% to 95%

Some studies have shown better results after release of the anterior compartment when compared to release of the deep posterior compartment. One study reported 96% excellent results after release for anterior compartment symptoms compared to 25% excellent (65% satisfactory) results after release for deep posterior compartment symptoms. Generally, the results after fasciotomy in carefully selected patients have resulted in improvement of symptoms in 80% to 95% of patients.Correct Answer: 80% to 95%

3035. (2070) Q7-2490:

Slide 1

The magnetic resonance image in this distance runner (Slide) reveals:

1) Iliopsoas tendinitis
3) Pelvic stress fracture
2) Hip flexor injury
5) Subtrochanteric stress fracture
4) Femoral neck stress fracture

The magnetic resonance image reveals a compression side femoral neck stress reaction. A compression side femoral neck stress reaction should be treated with restricted weight bearing to a pain free level. If the reaction/fracture progresses to more than 50% involvement of the neck, it can be treated with percutaneous screw fixation to avoid the disastrous complication of a displaced femoral neck stress fracture.Correct Answer: Femoral neck stress fracture

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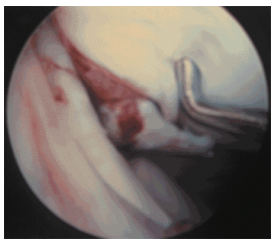
3036. (2071) Q7-2491:



Slide 1

The following arthroscopic photograph (Slide) of a right knee intercondylar notch reveals:

1) A loose body
3) A posterior cruciate ligament tear
2) An anterior cruciate ligament tear
5) Posterior meniscofemoral ligament tear
4) A meniscal tear

Isolated posterior cruciate ligament (PCL) injuries are treated conservatively, whereas combined PCL injuries/grade 3 PCL injuries are typically managed operatively.Correct Answer: A posterior cruciate ligament tear

---

3037. (2072) Q7-2493:

Slide 1

The femoral tunnel position in a right knee (Slide) is:

1) Appropriate for posterior cruciate ligament reconstruction
3) Too anterior for ACL reconstruction
2) Appropriate for anterior cruciate ligament (ACL) reconstruction
5) Too posterior for ACL reconstruction
4) Too vertical for ACL reconstruction

The appropriate position for femoral tunnel placement during ACL reconstruction is 10 or 10:30 in the right knee and 1:30 or 2:00 in the left knee.Correct Answer: Appropriate for anterior cruciate ligament (ACL) reconstruction

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3038. (2194) Q7-2621:

In which of the following positions in baseball are athletes most frequently injured:

1) Pitcher
3) Infielder
2) Catcher
5) Base runner
4) Outfielder

Pitchers are more prone to injury than any other position in baseball.Correct Answer: Pitcher

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3039. (2195) Q7-2622:

During pitching, upon landing normal lower extremity rotation of the lead leg is:

1) Neutral
3) 45Â° internal rotation
2) 15Â° internal rotation
5) 45Â° external rotation
4) 15Â° external rotation

During normal pitching mechanics, the lead leg should land in approximately 15Â° of internal rotation.Correct Answer: 15Â° internal rotation

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3040. (2196) Q7-2623:

During pitching, which of the following best describes the position of the arm during ball release:

1) 60Â° to 80Â° shoulder abduction, 40Â° to 60Â° shoulder external rotation, and 20Â° elbow flexion
3) 80Â° to 100Â° shoulder abduction, 40Â° to 60Â° shoulder external rotation, and 0Â° elbow flexion
2) 80Â° to 100Â° shoulder abduction, 60Â° to 80Â° shoulder external rotation, and 20Â° elbow flexion
5) 80Â° to 100Â° shoulder abduction, 60Â° to 80Â° shoulder external rotation, and 0Â° elbow flexion
4) 80Â° to 100Â° shoulder abduction, 40Â° to 60Â° shoulder external rotation, and 20Â° elbow flexion

During pitching, the ball is released with the arm positioned in 80Â° to 100Â° shoulder abduction, 40Â° to 60Â° shoulder external rotation, and 20Â° elbow flexion.Correct Answer: 80Â° to 100Â° shoulder abduction, 40Â° to 60Â° shoulder external rotation, and 20Â° elbow flexion

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3041. (2197) Q7-2624:

Slide 1

The magnetic resonance image (MRI) of a 16-year-old high school football player who sustained a knee injury during a game is presented (Slide). He reports mild swelling at the time of injury but does not recall hearing a "pop." He has attempted to return to football but is unable to make side-to-side movements. On clinical examination, no difference in anterior or posterior laxity is appreciated when comparing the injured knee to the uninjured knee. What is the most appropriate initial management:

1) Open reduction internal fixation of the tibial plateau fracture
3) Medial patellofemoral ligament reconstruction
2) Percutaneous fixation of the tibial plateau fracture
5) Functional rehabilitation with progressive return to play
4) Medial collateral ligament repair

The MRI demonstrates an isolated injury to the medial collateral ligament with an associated lateral tibial plateau bone contusion. Appropriate initial management consists of functional rehabilitation with progressive return to play.Correct Answer: Functional rehabilitation with progressive return to play

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3042. (2198) Q7-2625:

A 20-year-old male weightlifter presents with shoulder pain of insidious onset that occurs predominantly with bench press and military press activities. Clinical examination reveals tenderness on the superior aspect of the shoulder and pain with cross body adduction. No weakness or instability is noted. The most likely diagnosis is:

1) Osteolysis of the distal clavicle
3) Small rotator cuff tear
2) Acromioclavicular joint arthritis
5) Glenoid labrum tear
4) Microinstability of the glenohumeral joint

The most likely diagnosis is osteolysis of the distal clavicle. Osteolysis of the distal clavicle is a phenomenon that affects weightlifters and is exacerbated by bench press exercises.Correct Answer: Osteolysis of the distal clavicle

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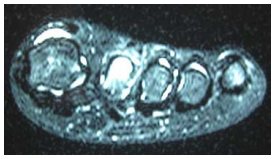
3043. (2199) Q7-2626:



Slide 1

A magnetic resonance image (MRI) of the right foot of a 16-year-old female cross-country runner is presented. The patient complains of progressive pain in her right foot. Recommended initial management should include:

1) Excisional biopsy
3) Resumption of activities as tolerated
2) A period of nonweight bearing with further workup including nutritional and endocrine evaluation
5) Incisional biopsy
4) Open reduction internal fixation

The MRI demonstrates a stress fracture of the second metatarsal. Appropriate initial management includes a period of nonweight bearing, as well as assessment of risk factors for additional stress fractures such as poor nutrition and amenorrhea.Correct Answer: A period of nonweight bearing with further workup including nutritional and endocrine evaluation

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3044. (2200) Q7-2627:

Slide 1

A magnetic resonance image (MRI) of both legs of a 32-year-old male marathon runner with progressive distal right leg pain is shown (Slide). Recommended initial management includes:

1) Unreamed intramedullary nailing
3) A period of nonweight bearing
2) Incisional biopsy
5) Reamed intramedullary nailing
4) Resumption of activities as tolerated

The MRI demonstrates a stress fracture of the tibia. Appropriate initial management is a period of nonweight bearing.Correct Answer: A period of nonweight bearing

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3045. (2201) Q7-2628:

Slide 1

A magnetic resonance image (MRI) of the left hip of a 26-year-old female triathlete with progressive pain is shown (Slide). Recommended initial management includes:

1) Percutaneous fixation with cannulated screws
3) Incisional biopsy
2) Resumption of activities as tolerated
5) A period of nonweight bearing with further workup including nutritional and menstrual history
4) Fixation with a dynamic hip screw

The MRI demonstrates an incomplete compression-sided femoral neck stress fracture. Appropriate initial management is a period of nonweight bearing as well as assessment of risk factors (e.g., poor nutrition and amenorrhea) for additional stress fractures. Tension-sided and complete femoral neck stress fractures should be treated with fixation to avoid fracture displacement and to promote union.Correct Answer: A period of nonweight bearing with further workup including nutritional and menstrual history

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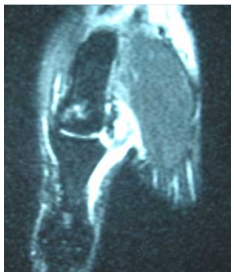
3046. (2202) Q7-2629:



Slide 1

A 19-year-old collegiate level volleyball player injured her right thumb during a game. A magnetic resonance image (MRI) through the metacarpophalangeal joint is shown (Slide). What is the diagnosis:

1) Extensor tendon disruption
3) Volar plate disruption
2) Complete unar collateral ligment tear
5) Ulnar collateral ligament sprain
4) Incomplete ulnar collateral ligament tear

The MRI reveals a complete disruption of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb.Correct Answer: Complete unar collateral ligment tear

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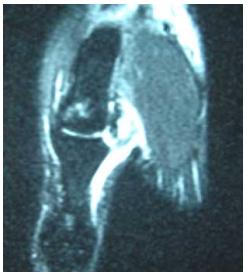
3047. (2203) Q7-2630:



Slide 1

A 19-year-old collegiate level volleyball player injured her right thumb during a game. A magnetic resonance image (MRI) through the metacarpophalangeal joint is shown (Slide). What is the appropriate initial management:

1) Thumb spica cast for 6 weeks
3) Ulnar collateral ligament reconstruction with palmaris longus graft
2) Therapy to regain mobility and function
5) Excisional biopsy
4) Ulnar collateral ligament repair

The MRI reveals a complete disruption of the ulnar collateral ligament of the metacarpophalangeal joint of the thumb. The preferred treatment for complete disruptions of the ulnar collateral ligament is acute repair.Correct Answer: Ulnar collateral ligament repair

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3048. (2204) Q7-2631:

Which of the following injuries is most often responsible for death in youth baseball:

1) Head injury
3) Pelvic injury
2) Abdominal injury
5) Spinal cord injury
4) Cardiac injury

Catastrophic injuries are rare in baseball. In the few deaths that have occurred, most have resulted from a blow to the chest resulting in cardiac injury. The gravest prognosis occurs with commotion cordis, which results from a direct blow to the chest causing dysrhythmia even if resuscitative care is immediately provided.Correct Answer: Cardiac injury

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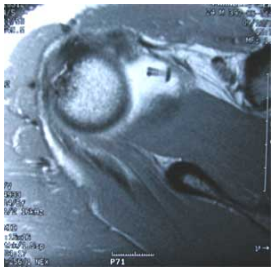
3049. (2205) Q7-2632:



Slide 1

A magnetic resonance image (MRI) of a 24-year-old, right-hand dominant minor league baseball pitcher is presented (Slide). He has undergone two shoulder arthroscopies within the past year. He currently complains of vague shoulder pain and a catching or locking sensation when attempting to pitch. Which of the following is most likely responsible for his symptoms:

1) Internal impingement
3) Recurrent labral tear
2) Loose foreign body with associated synovitis
5) Anterior shoulder instability
4) Rotator cuff tear

The MRI shows an intra-articular loose foreign body, presumably a bioabsorbable tack from a previous shoulder surgery. Multiple researchers have observed synovitic reactions from bioabsorbable implants in the glenohumeral joint.Correct Answer: Loose foreign body with associated synovitis

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3050. (2206) Q7-2633:

Slide 1

The magnetic resonance image (MRI) of a 29-year-old recreational bodybuilder is shown (Slide). He states that he felt a pop in the right shoulder girdle while "maxing out" on bench press. What is the most appropriate treatment:

1) Physical therapy to restore mobility and function
3) Acute repair of the injured structure
2) Sling usage for 6 weeks
5) Incisional biopsy of the lesion
4) Delayed repair of the injured structure

This patient has a rupture of the pectoralis major muscle. Although delayed repair can yield acceptable results in young, active patients, most surgeons advocate early repair for restoration of strength and cosmesis.Correct Answer: Acute repair of the injured structure

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3051. (2207) Q7-2634:

Slide 1

A magnetic resonance image (MRI) of a 16-year-old high school football player who sustained a knee injury during a game is presented (Slide). He reports mild swelling at the time of injury but does not recall hearing a "pop." He has attempted to return to football, but he is unable to make side to side movements. On clinical examination, no difference in anterior or posterior laxity is appreciated when comparing the injured knee to the uninjured knee. What is the most likely diagnosis:

1) Anterior cruciate ligament injury
3) Medial patellofemoral ligament injury
2) Medial collateral ligament injury
5) Posterior cruciate ligament injury
4) Medial meniscal tear

The MRI demonstrates an isolated injury to the medial collateral ligament with an associated lateral tibial plateau bone contusion. Appropriate initial management consists of functional rehabilitation.Correct Answer: Medial collateral ligament injury

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3052. (2208) Q7-2635:

Slide 1

A magnetic resonance image (MRI) of a 15-year-old female volleyball player who twisted her knee is shown (Slide). Despite 6 weeks of rehabilitation, she has been unable to return to volleyball without having her knee give out. What is the most likely diagnosis:

1) Anterior cruciate ligament injury
3) Medial patellofemoral ligament injury
2) Medial collateral ligament injury
5) Posterior cruciate ligament injury
4) Medial meniscal tear

The MRI clearly shows disruption of the femoral attachment of the anterior cruciate ligament with characteristic joint effusion.Correct Answer: Anterior cruciate ligament injury

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3053. (2209) Q7-2636:

Slide 1

A magnetic resonance image (MRI) of a 15-year-old female volleyball player who twisted her knee is presented (Slide). Despite 6 weeks of rehabilitation, she has been unable to return to volleyball without having her knee give out. If left untreated, which of the following structures is prone to injury with repetitive "giving way" episodes:

1) Lateral collateral ligament
3) Medial patellofemoral ligament
2) Medial collateral ligament
5) Posterior cruciate ligament
4) Menisci

The MRI clearly shows disruption of the femoral attachment of the anterior cruciate ligament with characteristic joint effusion. With repetitive "giving way" episodes, the menisci are vulnerable to injury, particularly in the adolescent population. Graf and colleagues reported that seven of eight skeletally immature patients with anterior cruciate ligament injuries treated nonoperatively went on to develop meniscal tears.Correct Answer: Menisci

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3054. (2210) Q7-2637:

Slide 1

A magnetic resonance image (MRI) of a 15-year-old female volleyball player who twisted her knee is shown (Slide). Despite 6 weeks of rehabilitation, she has been unable to return to volleyball without having her knee give out. What is the most appropriate treatment:

1) Anterior cruciate ligament reconstruction
3) Continued physical therapy
2) Posterior cruciate ligament reconstruction
5) Medial patellofemoral ligament reconstruction
4) Use of a knee brace

The MRI clearly shows disruption of the femoral attachment of the anterior cruciate ligament with characteristic joint effusion. The most appropriate treatment for the patient in this scenario is anterior cruciate ligament reconstruction.Correct Answer: Anterior cruciate ligament reconstruction

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3055. (2211) Q7-2638:

Slide 1

A magnetic resonance image (MRI) of a 21-year-old female collegiate basketball player who felt her knee give out while playing is shown (Slide). What is the injured structure:

1) Lateral collateral ligament
3) Medial patellofemoral ligament
2) Medial collateral ligament
5) Posterior cruciate ligament
4) Meniscus

This patient dislocated her patella, and the MRI demonstrates the pathoanatomical lesion of traumatic patellar dislocation â disruption of the medial patellofemoral ligament. Initial management of these injuries is generally nonoperative, although some surgeons now advocate early repair or reconstruction of the medial patellofemoral ligament in the athletic population.Correct Answer: Medial patellofemoral ligament

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3056. (2212) Q7-2639:

Good prognostic signs for patients with arthroscopic treatment of degenerative arthritis of the knee incude:

1) Malalignment
3) Loose bodies
2) Advanced degenerative changes
5) Pending litigation
4) Chondrocalcinosis

Good prognostic signs for patients undergoing arthroscopic treatment of a degenerative knee include increased pain of acute onset, mechanical symptoms, recent effusion, loose bodies, normal alignment, isolated chondral flap/fracture, and meniscal tears. Poor prognostic signs include malalignment, ligamentous instability, pending litigation, and complete loss of the joint space.Correct Answer: Loose bodies

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3057. (2213) Q7-2640:

The reported 3- to 5-year success rate of a chondral lesion microfracture technique in the knee is:

1) 10% improvement
3) 40% improvement
2) 25% improvement
5) 95% improvement
4) 75% improvement

Steadman and colleagues reported a 75% improvement at 3- to 5-year follow-up using the microfracture technique with arthroscopic awls.Correct Answer: 75% improvement

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3058. (2214) Q7-2641:

Which of the following is not a high-risk stress fracture:

1) Navicular
3) Anterior tibial diaphysis
2) Femoral neck
5) Proximal 5th metatarsal
4) Posteromedial tibia

Posteromedial tibial stress fractures are not considered high-risk fractures and can be treated with relative rest and staying at an asymptomatic level of activity. Complete fracture, nonunion, or other complications are rare after posteromedial tibial stress fractures.Correct Answer: Posteromedial tibia

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3059. (2516) Q7-2987:

Meniscus repair is most successful for tears in which of the following zones:

1) Red-blue zone
3) Red-white zone
2) Red-red zone
5) White-red zone
4) White-white zone

The microvascular anatomy of the meniscus was initially defined by Arnoczky and Warren in 1982. They demonstrated that the perimeniscal capillary plexus supplies the most peripheral region of the meniscus with blood and that this blood supply is centrally insufficient. Their finding accurately predicted that peripheral tears would have a better chance of healing than more central tears. Subsequently, the menisci were divided into three regions based upon the blood supply. These three regions are the red-red zone (peripheral third), the red-white zone (middle third), and the white-white zone (central third). The zone names correlate with the rich peripheral and poor central blood supply.Correct Answer: Red-red zone

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3060. (2517) Q7-2988:

Which of the following does not improve meniscal repair outcomes in avascular zones:

1) Concomitant anterior cruciate ligament (ACL) reconstruction
3) Synovial abrasion
2) Fibrin clot
5) Hyalgan injections
4) Vascular access channels

Several techniques have been implemented to improve the outcome of meniscus repair. Patients undergoing concomitant ACL reconstruction have better results than patients with an ACL tear that is not addressed or those with no ACL tear. Fibrin clot is known to improve healing due to growth factors present in the clot. Synovial abrasion and vascular access channels are two less commonly used techniques that augment meniscal healing. Hyalgan injections have no proven benefit for meniscal healing.Correct Answer: Hyalgan injections

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3061. (2518) Q7-2989:

Which tear pattern is most responsive to meniscus repair:

1) Radial
3) Parrot beak
2) Complex
5) Horizontal cleavage
4) Longitudinal

Longitudinal tears are the most responsive tear pattern to successful repairs. Longitudinal tears occur in the plane of the radial orientation of the meniscal infrastructure. Other patterns of tears disrupt this radial orientation, resulting in high stress across the repair site and difficulty in reconstituting lost meniscal function.Correct Answer: Longitudinal

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3062. (2519) Q7-2990:

Which head of the pectoralis major muscle most likely remains intact with a partial rupture:

1) Sternocostal
3) Clavicular
2) Sternoclavicular
5) Superior
4) Costal

There are two heads of the pectoralis major â the clavicular head inserts anteriorly and the sternocostal head inserts posteriorly. The clavicular head remains intact in a partial rupture.Correct Answer: Clavicular

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3063. (2520) Q7-2991:

In 1948, T.J. Fairbank, MD, published a landmark article on which of the following topics:

1) Classification of articular cartilage injuries
3) Short-term radiographic changes after total meniscectomy
2) Long-term radiographic changes after total meniscectomy
5) The effect of anterior cruciate ligament reconstruction on arthritis
4) Short-term radiographic changes after partial meniscectomy

T.J. Fairbank, MD, published a landmark article in 1948 on the long-term radiographic changes after total meniscectomy. The radiographic changes that now bear his name (Fairbank changes) refer to osteophyte formation, joint space narrowing, and flattening of the femoral condyles.Correct Answer: Long-term radiographic changes after total meniscectomy

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3064. (2521) Q7-2992:

Which of the following meniscus repair techniques results in the highest pullout strength:

1) Meniscus arrows
3) Vertical mattress sutures
2) Horizontal mattress sutures
5) Fibrin clot
4) Fibrin glue

Vertical mattress sutures have been proven to be the gold standard for comparison of all other meniscus repair techniques. The suture pattern yields the highest pullout strength for load to failure and cyclic loading testing.Correct Answer: Vertical mattress sutures

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3065. (2522) Q7-2993:

Which of the following is the most important factor for meniscus repair success:

1) Location of tear
3) Age of patient
2) Pattern of tear
5) Stability of the knee
4) Age of tear

The location of the tear is the most important factor in meniscus repair. Tears in the peripheral red-red zone have the highest likelihood of healing, whereas tears in the central white-white zone are less likely to heal.Correct Answer: Location of tear

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3066. (2523) Q7-2994:

Which structure makes up the anterior boundary of Hunterâs canal (adductor canal):

1) Vastus medialis
3) Sartorius
2) Vastus lateralis
5) Semitendinosus
4) Pectineus

Hunterâs canal (adductor canal) is bound anterolaterally by the vastus medialis, posterolaterally by the adductor longus, and medially by the sartorius.Correct Answer: Sartorius

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3067. (2524) Q7-2995:

Which of the following structures is the major stabilizer of the knee to valgus stress at 30Â°:

1) Posterior oblique ligament
3) Superficial medial collateral ligament
2) Deep medial collateral ligament
5) Anterior cruciate ligament
4) Medial meniscus

The major stabilizer of the knee to valgus load at 30Â° of flexion is the superficial medial collateral ligament. The deep medial collateral ligament and the posterior oblique ligament also contribute to stability of the knee, but they are not as important as the superficial medial collateral ligament at 30Â°. The anterior cruciate ligament plays a secondary role in valgus stability; however, it functions mostly in full extension.Correct Answer: Superficial medial collateral ligament

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3068. (2525) Q7-2996:

Which of the following is the most commonly injured knee ligament:

1) Lateral collateral ligament
3) Anterior cruciate ligament
2) Medial collateral ligament
5) Falciform ligament
4) Posterior cruciate ligament

The medial collateral ligament is the most commonly injured ligament of the knee. Generally, these injuries are treated nonoperatively and many are overlooked or not diagnosed by a physician. Anterior cruciate ligament injuries are the second most common injury, but they most often result in surgical reconstruction. Posterior cruciate ligament injuries are less common but are under-recognized.Correct Answer: Medial collateral ligament

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3069. (2526) Q7-2997:

Where is the most common site of a medial collateral ligament injury:

1) Tibial insertion
3) Mid substance
2) Femoral origin
5) Inferior pole of the patella
4) Fibular head

The most common site of a medial collateral ligament injury is the femoral origin. Midsubstance injuries occur less commonly. Injuries at the tibial insertion generate some controversy, and some authors advocate surgical repair, citing inferior results with conservative management.Correct Answer: Femoral origin

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3070. (2527) Q7-2998:

Which of the following structures is tested with an external rotation recurvatum test:

1) Posterolateral corner
3) Medial collateral ligament
2) Anterior cruciate ligament
5) Medial meniscus
4) Posterior cruciate ligament

The external rotation recurvatum test evaluates the posterolateral corner. The test is performed with a patient in the supine position. The great toe of each foot is grasped and lifted as the patient is relaxed. The injured knee will hyperextend and drift into varus with a positive test.Correct Answer: Posterolateral corner

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3071. (2528) Q7-2999:

Which of the following structures is most commonly injured in conjunction with a posterior cruciate ligament rupture:

1) Anterior cruciate ligament
3) Medial collateral ligament
2) Posterolateral corner
5) Patellar tendon
4) Lateral meniscus

The posterolateral corner is most often associated with posterior cruciate ligament injuries. Patients who fail conservative management of posterior cruciate ligament injuries often have an associated posterolateral corner injury.Correct Answer: Posterolateral corner

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3072. (2529) Q7-3000:

What is the most appropriate management for treatment of an isolated grade I medial collateral ligament (MCL) injury:

1) Anterior cruciate ligament reconstruction
3) Nonoperative treatment with 2 to 4 weeks in a cylinder cast, followed by range of motion and strengthening
2) Nonoperative treatment with an optional short course of immobilization, followed by range of motion and strengthening
5) Surgical repair of the MCL
4) Nonoperative treatment with immediate return to sport

Isolated grade I MCL injuries are best treated with a short course of immobilization (few days at most), followed by range of motion and strengthening as pain allows. Patients can generally return to sport within 2 weeks.Correct Answer: Nonoperative treatment with an optional short course of immobilization, followed by range of motion and strengthening

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3073. (2530) Q7-3001:

What is the most appropriate treatment of an isolated grade II medial collateral ligament (MCL) injury:

1) Anterior cruciate ligament reconstruction
3) Nonoperative treatment with 4 to 6 weeks in a cylinder cast, followed by range of motion and strengthening
2) Nonoperative treatment with a short course of immobilization, followed by range of motion and strengthening. Patients can return to sport within 4 weeks.
5) Surgical repair of the MCL
4) Nonoperative treatment with immediate return to sport

Isolated grade II MCL injuries are best treated with a short course of immobilization (up to 1 week), followed by range of motion and strengthening as pain allows. Patients can generally return to sport within 4 weeks.Correct Answer: Nonoperative treatment with a short course of immobilization, followed by range of motion and strengthening. Patients can return to sport within 4 weeks.

3074. (2531) Q7-3002:

What is the major technical limitation of open meniscus repair:

1) Cannot use sutures for the repair
3) Cannot repair peripheral tears
2) Cannot place vertical mattress sutures
5) Poor long-term results
4) Cannot access central tears

The major limitation to open meniscus repair is the poor access to more central tears. The long-term results of meniscus repair have been good.Correct Answer: Cannot access central tears

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3075. (2532) Q7-3003:

Which of the following is the main advantage of an all-inside meniscus repair compared to an inside-out repair:

1) Cheaper implants
3) Ease of use, less operative time, and no incision
2) Biomechanically superior repair
5) Better long-term results
4) Fewer implant complications

The main advantages to all-inside repair are ease of use, less operative time, and lack of an incision. Currently, there are still complications with implants, but these are improving over time. The vertical mattress suture of an inside-out repair is still superior to an all-inside implant biomechanically, but the newer generation of implants is improving. Although an inside-out technique is biomechanically superior, several studies indicate equivalent outcomes between all-inside and inside-out techniques.Correct Answer: Ease of use, less operative time, and no incision

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3076. (2533) Q7-3004:

Which adductor muscle is most commonly injured in a groin strain:

1) Adductor brevis
3) Adductor magnus
2) Adductor longus
5) Sartorius
4) Pectineus

The adductor longus is the most frequently injured of the adductor muscles. The adductor brevis and pectineus muscles are short; therefore, they are relatively protected. The adductor magnus has a larger muscle belly than the adductor longus but is still not injured as often. The sartorius crosses two joints and is the longest muscle-tendon unit in the body. The sartorius is often injured but less frequently than the adductor longus.Correct Answer: Adductor longus

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3077. (2534) Q7-3005:

Where is the primary pathology site for athletic pubalgia:

1) Sartorius origin
3) Rectus abdominus insertion
2) Rectus abdominus origin
5) Ischial tuberosity
4) Inguinal canal

The primary pathology site of athletic pubalgia is believed to be the rectus abdominus insertion on the pubis. This is a diagnosis of exclusion and some authors question its existence. An athlete generally has pain in the lower abdominal and groin area. A hernia is not present and, generally, patients fail a course of conservative management of a groin strain before the diagnosis is made. Patients generally have pain with palpation at the rectus abdominus insertion on the pubis. Surgical management involves an open Bassini hernia repair.Correct Answer: Rectus abdominus insertion

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3078. (2535) Q7-3006:

Which of the following physical examination maneuvers is suggestive of piriformis syndrome:

1) Forced internal rotation of an extended thigh
3) Forced internal rotation of a flexed thigh
2) Forced external rotation of a flexed thigh
5) Forced internal rotation of a flexed knee
4) Forced external rotation of an extended thigh

Piriformis syndrome is an uncommon ailment in which patients generally complain of posterior buttock and thigh pain. A lumbar spine etiology must be ruled out first. Piriformis syndrome is often a diagnosis of exclusion. Few physical examination findings suggest the diagnosis. A patient may have pain with direct palpation over the piriformis muscle, but the more suggestive finding is pain elicited from forced internal rotation of an extended thigh.Correct Answer: Forced internal rotation of an extended thigh

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3079. (2536) Q7-3007:

What is the name of the sign elicited with the test for piriformis syndrome:

1) Wilsonâs sign
3) Pellegrini-Stieda sign
2) McMurrayâs sign
5) Paceâs sign
4) Hoffmanâs sign

Paceâs sign is the name given to pain elicited with forced internal rotation of a flexed hip and is suggestive of piriformis syndrome if patient history correlates with the examination. Wilsonâs sign is associated with osteochondritis dissecans of the knee. McMurrayâs sign is associated with meniscus tears of the knee. Pellegrini-Stieda sign refers to a radiographic finding of chronic medial collateral ligament injuries. Hoffmanâs sign is associated with cervical stenosis.Correct Answer: Paceâs sign

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3080. (2537) Q7-3008:

Which population of athletes most commonly presents with snapping hip syndrome due to the iliopsoas tendon:

1) Soccer players
3) Gymnasts
2) Football players
5) Bowlers
4) Long distance runners

Snapping iliopsoas tendon syndrome is most common in long distance runners. Other athletes may have groin pain, but the etiology generally differs. Soccer players and football players often have adductor strains due to the ballistic nature of the sport. Gymnasts may have several sources of groin pain including adductor strains, acetabular labral tears, or iliopsoas tendon syndrome. Soccer players may also have athletic pubalgia. The repetitive nature of long distance running seems to predispose those athletes to snapping iliopsoas tendon syndrome.Correct Answer: Long distance runners

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3081. (2538) Q7-3009:

Which of the following muscles is the strongest flexor of the hip joint:

1) Rectus femoris
3) Adductor magnus
2) Sartorius
5) Biceps femoris
4) Iliopsoas

The iliopsoas is the strongest flexor of the hip joint. The sartorius and rectus femoris are also hip flexors. The biceps femoris extends the hip, and the adductor magnus mainly adducts the hip.Correct Answer: Iliopsoas

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3082. (2539) Q7-3010:

Which type of injury is evaluated by Gaenslenâs test:

1) Iliopsoas tendinitis
3) Osteitis pubis
2) Acetabular labral tear
5) Sacroiliac sprain
4) Hamstring strain

Gaenslenâs test is performed by hyperflexing the uninjured hip while hyperextending the hip on the painful side. If this causes pain over the sacroiliac joint, then it is considered a positive test for a sacroiliac sprain.Correct Answer: Sacroiliac sprain

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3083. (2540) Q7-3011:

Which of the following structures is compressed or occluded in quadrilateral space syndrome:

1) Anterior circumflex humeral artery
3) Radial nerve
2) Posterior circumflex humeral artery
5) Axillary artery
4) Profunda brachii artery

The quadrilateral (quadrangular) space is bound by the teres minor superiorly, teres major inferiorly, long head of the triceps medially, and the lateral head of the biceps laterally. The axillary nerve and posterior circumflex humeral vessels pass through this space. Quadrilateral space syndrome is defined by pain and paresthesias with the shoulder abducted, extended, and externally rotated, which transiently occludes the posterior circumflex humeral vessels.Correct Answer: Posterior circumflex humeral artery

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3084. (2541) Q7-3012:

Where is Voshellâs bursa located:

1) Between the superficial and deep medial collateral ligaments of the knee
3) Lateral to the greater trochanter of the hip
2) In the subscapularis fossa of the shoulder
5) Posterior to the medial head of the gastrocnemius of the knee
4) Superficial to the hamstring tendons of the knee

Voshellâs bursa is located between the deep and superficial medial collateral ligament of the knee.Correct Answer: Between the superficial and deep medial collateral ligaments of the knee

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3085. (2668) Q7-3161:

Which of the following lends the greatest stability to the sternoclavicular joint:

1) Bony articular congruity
3) Costoclavicular ligament
2) Articular disk
5) Interclavicular ligament
4) Sternoclavicular capsular ligament

The sternoclavicular joint is a fairly incongruous diarthrodial joint consisting of the medial aspect of the clavicle, the sternum, and an intervening cartilaginous articular disk. The articular disk accommodates for some of the incongruence between the medial aspect of the clavicle and the sternum; however, the majority of stability of the sternoclavicular joint is imparted by the strong surrounding ligamentous complex. This ligamentous complex is comprised of the capsular ligament, the interclavicular ligament, the costoclavicular or rhomboid ligament, and the intra-articular disk ligment. Of these ligaments, the capsular ligament imparts the most stability to the joint.Correct Answer: Sternoclavicular capsular ligament

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3086. (2669) Q7-3162:

What is the most common mechanism of anterior dislocation of the sternoclavicular joint:

1) A medially directed force applied to the lateral aspect of the externally rotated shoulder girdle
3) A medially directed force applied to the lateral aspect of the neutrally rotated shoulder girdle
2) A medially directed force applied to the lateral aspect of the internally rotated shoulder girdle
5) A superiorly directed force applied to the medial aspect of the clavicle
4) An inferiorly directed force applied to the medial aspect of the clavicle

The mechanism of sternoclavicular joint injury may be direct or indirect. Direct injury involves posteriorly directed forces applied to the medial aspect of the clavicle resulting in proximal clavicular fracture and/or posterior sternoclavicular dislocation. More commonly, indirect mechanisms are responsible for sternoclavicular joint injury. Indirect injury occurs when a medial directed force is applied to the lateral aspect of the shoulder. As this force is applied, if the shoulder girdle externally rotates, an anterior sternoclavicular dislocation can occur. If the shoulder internally rotates, then a posterior sternoclavicular joint dislocation may ensue.Correct Answer: A medially directed force applied to the lateral aspect of the externally rotated shoulder girdle

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3087. (2670) Q7-3163:

What is the most common mechanism of posterior dislocation of the sternoclavicular joint:

1) An inferiorly directed force applied to the medial aspect of the clavicle
3) A medially directed force applied to the lateral aspect of the externally rotated shoulder girdle
2) A superiorly directed force applied to the medial aspect of the clavicle
5) A medially directed force applied to the lateral aspect of the neutrally rotated shoulder girdle
4) A medially directed force applied to the lateral aspect of the internally rotated shoulder girdle

The mechanism of sternoclavicular joint injury may be direct or indirect. Direct injury involves posteriorly directed forces applied to the medial aspect of the clavicle resulting in proximal clavicular fracture and/or posterior sternoclavicular dislocation. More commonly, indirect mechanisms are responsible for sternoclavicular joint injury. Indirect injury occurs when a medial directed force is applied to the lateral aspect of the shoulder. As this force is applied, if the shoulder girdle externally rotates, then an anterior sternoclavicular dislocation can occur. If the shoulder internally rotates, a posterior sternoclavicular joint dislocation may ensue.Correct Answer: A medially directed force applied to the lateral aspect of the internally rotated shoulder girdle

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3088. (2671) Q7-3164:

At what age does the medial clavicular physis close:

1) 8 years
3) 17 years
2) 13 years
5) 25 years
4) 20 years

The proximal clavicular physis is the last in the body to close with the proximal clavicular epiphysis uniting with the metaphysis usually between the 23rd and 25th year, possibly as late as the 31st year. This becomes important when evaluating sternoclavicular joint injuries in patients younger than 30 years as many of the suspected dislocations are actually proximal clavicular physeal fractures.Correct Answer: 25 years

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3089. (2672) Q7-3165:

Which of the following is the most common pattern of sternoclavicular joint dislocation:

1) Superior
3) Inferior
2) Anterior
5) Posterior inferior
4) Posterior superior

Athletic-related injuries to the sternoclavicular joint range from sprains to fractures and/or dislocations. Most injuries are sprains involving stretching or incomplete tearing of the sternoclavicular ligaments. More significant ligamentous injury may result in sternoclavicular subluxation (transient loss of articular apposition of the sternoclavicular joint resolving spontaneously) or dislocation. More than 90% of dislocations occur in the anterior direction.Correct Answer: Anterior

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3090. (2673) Q7-3166:

A 32-year-old man sustains an injury as a result of being on the bottom of a pile during a rugby game. He complains of pain at the medial aspect of his clavicle. He is having difficulty swallowing water and feels like his âthroat is closing.â Physical examination demonstrates obvious swelling at the medial aspect of the clavicle and sternoclavicular joint. His radial pulse in his ipsilateral hand is also slightly decreased compared to the contralateral radial pulse. What is the most likely diagnosis:

1) Anterior sternoclavicular joint dislocation
3) Inferior sternoclavicular joint dislocation
2) Posterior sternoclavicular joint dislocation
5) Medial clavicular physeal fracture
4) Superior sternoclavicular joint dislocation

Presentation of patients with sternoclavicular joint injuries varies with the type of injury sustained. Patients with sprains and subluxations of the sternoclavicular joint present with complaints of tenderness at the medial aspect of the clavicle and sternoclavicular pain with shoulder movement. The patient may sustain the injury through an indirect mechanism as a result of being on the bottom of a pile while participating in football or rugby.

Patients with anterior dislocation of the sternoclavicular joint usually present with an obvious deformity with the medial aspect of the clavicle protruding anteriorly. These injuries are usually sustained when the patient is on the bottom of a pile during football or rugby, and the ipsilateral shoulder girdle is externally rotated during simultaneous lateral compression.

Patients with posterior sternoclavicular joint dislocations often present with more serious symptoms. In addition to severe pain and an obvious deformity with the medial aspect of the clavicle protruding posteriorly, patients often complain of dyspnea, dysphagea, and throat pain. Additionally, signs of vascular compromise to the ipsilateral upper extremity may occur.

Correct Answer: Posterior sternoclavicular joint dislocation

3091. (2674) Q7-3167:

Which of the following is the imaging modality of choice for evaluation of sternoclavicular joint injuries:

1) Simple radiography
3) Magnetic resonance imaging
2) Ultrasonography
5) Double contrast arthrography
4) Computed tomography

Assessment of the sternoclavicular joint using simple radiography is exceptionally difficult. Secondary imaging using computed tomography, which readily identifies fractures and dislocations involving the sternoclavicular joint, is the imaging modality of choice in evaluation of sternoclavicular joint injuries.Correct Answer: Computed tomography

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3092. (2675) Q7-3168:

A 32-year-old man sustains an injury as a result of being on the bottom of a pile during a rugby game. He complains of pain at the medial aspect of his clavicle. He is having difficulty swallowing water and feels like his âthroat is closing.â Physical examination demonstrates obvious swelling at the medial aspect of the clavicle and sternoclavicular joint. His radial pulse in his ipsilateral hand is also slightly decreased compared to the contralateral radial pulse. After confirming the diagnosis with appropriate imaging studies, what is the most appropriate treatment:

1) Symptomatic treatment with progressive return to rugby
3) Figure-of-eight splint for 6 weeks
2) Sling for 2 weeks
5) Emergent open reduction
4) Emergent closed reduction

Acute posterior sternoclavicular joint dislocations should be emergently reduced in a controlled environment. Closed reduction under anesthesia is usually successful and is performed by placing a rolled sheet between the patientâs scapulae, having an assistant apply longitudinal and posterior traction to the upper extremity, and applying an anteriorly directed force to the ipsilateral clavicle using pointed reduction forceps percutaneously. Closed reduction is usually successful. Failing closed reduction, open reduction is used.Correct Answer: Emergent closed reduction

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3093. (2676) Q7-3169:

Which best describes a type IIA distal clavicle fracture:

1) The fracture is lateral to the coracoclavicular ligaments.
3) The fracture line is between the conoid and trapezoid ligaments.
2) The fracture involves intra-articular injury of the acromioclavicular joint.
5) The fracture involves comminuted distal clavicle fracture.
4) The fracture is medial to the coracoclavicular ligaments.

A type IIA distal clavicle fracture occurs medial to the coracoclavicular ligaments. Type I is an extra-articular fracture lateral to the coracoclavicular ligaments. Type III is an intra-articular injury of the acromioclavicular joint.Correct Answer: The fracture is medial to the coracoclavicular ligaments.

3094. (2677) Q7-3170:

Distal one-third clavicle fractures constitute what percentage of all clavicle fractures:

1) 15%
3) 45%
2) 30%
5) 90%
4) 60%

Distal one-third clavicle fractures constitute 15% of all clavicle fractures. The most common location for a clavicle fracture is midshaft.Correct Answer: 15%

3095. (2678) Q7-3171:

What percentage of type II distal clavicle fractures results in nonunion with nonoperative management:

1) 15%
3) 45%
2) 30%
5) 90%
4) 60%

Few studies have looked at the nonunion rate for type II distal one-third clavicle fractures. These few studies, however, generally yield a 30% nonunion rate, the highest among any type of clavicle fracture.Correct Answer: 30%

3096. (2679) Q7-3172:

What is the most common type of discoid lateral meniscus:

1) Humphrey
3) Complete
2) Wrisberg
5) Partial
4) Incomplete

Discoid lateral menisci are divided into three types by the Watanabe classification system: Wrisberg, complete, and incomplete. Complete is the most common type. Incomplete and Wrisberg types are less common and approximately equal in incidence. Complete discoid meniscus implies that the abnormal meniscus covers the entire tibial plateau. Incomplete implies partial covering of the plateau. Wrisberg type is defined by a lack of attachment of the meniscotibial ligaments to the posterior horn of the lateral meniscus.Correct Answer: Complete

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3097. (2680) Q7-3173:

The gravity subluxation test is used to evaluate:

1) Anterior cruciate ligament deficiency
3) Lateral patellar subluxation
2) Posterior cruciate ligament deficiency
5) Shoulder subluxation
4) Medial patellar subluxation

The gravity subluxation test is used to evaluate medial patellar subluxation. The test is performed with the patient in the lateral decubitus position with the affected extremity up. The thigh is passively abducted by the examiner. If the patella subluxates medially, then the test is suggestive. It is definitively positive if active quadriceps contraction fails to bring the patella back into the groove.Correct Answer: Medial patellar subluxation

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3098. (2681) Q7-3174:

Detachment of the superior glenoid labrum:

1) Diminishes anterior shoulder stability
3) Increases anterior shoulder stability
2) Diminishes inferior shoulder stability
5) Diminishes global shoulder stability
4) Increases inferior shoulder stability

Biomechanical studies have shown that superior labrum anterior and posterior (SLAP) lesions allow increased anterior humeral head translation and decreased anterior stability of the glenohumeral joint. The superior labrum acts as a static stabilizer of the shoulder joint preventing anterior instability. Contraction of the long head of the biceps tightens the surrounding labrum and capsule at its attachment site, providing dynamic stability to the shoulder joint. SLAP lesions disrupt the static restraint of the labrum and decrease the effectiveness of the biceps to dynamically stabilize the shoulder. SLAP lesions diminish anterior stability primarily.Correct Answer: Diminishes anterior shoulder stability

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3099. (2682) Q7-3175:

Superior labrum anterior and posterior (SLAP) lesions affect a shoulder in the throwing position by:

1) Decreasing torsional rigidity
3) Decreasing axial rigidity
2) Increasing torsional rigidity
5) Decreasing angular rigidity
4) Increasing axial rigidity

Detachment of the labrum in SLAP lesions causes a decrease in the torsional stiffness of the shoulder in the throwing position of abduction and external rotation. This highlights the fact that the superior labral complex plays an important role in the stability of the shoulder. Biomechanical studies have shown that SLAP lesions play a role in destabilizing the shoulder and cause increased strain on the inferior glenohumeral ligament in the throwing position. Increased biceps muscle force allows the abducted and externally rotated shoulder joint to withstand higher external rotation forces (torque).Correct Answer: Decreasing torsional rigidity

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3100. (2683) Q7-3176:

Dynamic muscular stabilizers of the shoulder play an important role in stability. Which of the following is the most important dynamic stabilizer:

1) The rotator cuff
3) The coracobrachialis
2) The labrum
5) The biceps brachii
4) The latissimus dorsi

The rotator cuff is an important dynamic anterior stabilizer of the shoulder. The stability of the shoulder is maintained primarily by the shoulder musculature. The biceps brachii has been shown to act as a dynamic stabilizer of the shoulder, but the most important dynamic stabilizer is the rotator cuff.Correct Answer: The rotator cuff

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3101. (2684) Q7-3177:

Which of the following is not true regarding the function of the biceps in the shoulder:

1) The biceps helps prevent proximal migration.
3) The biceps provides a dynamic stabilizing effect on the shoulder.
2) The biceps plays an important role in anterior stability.
5) The biceps provides most of the dynamic stability of the shoulder joint.
4) The biceps increases the torsional stiffness of the shoulder in the throwing position.

The rotator cuff is the most important dynamic stabilizer of the shoulder. The biceps acts as a depressor of the humeral head against proximal migration. Biomechanical studies have demonstrated the importance of the biceps in anterior stability as well as its role as a dynamic stabilizer. Studies have also shown that the biceps increases the torsional stiffness of the shoulder in the throwing position.Correct Answer: The biceps provides most of the dynamic stability of the shoulder joint.

3102. (2685) Q7-3178:

Which of the following statements is not true regarding the shoulder capsule:

1) The rate of capsular stretch may determine where the capsular ligament is damaged.
3) Anterior shoulder dislocations usually cause some degree of capsular stretching.
2) Slower strain rates tend to cause disruption at the ligament insertion site.
5) Capsular injury is a common arthroscopic finding in patients who sustain an acute shoulder dislocation.
4) The shoulder capsule tends to be tight in patients with multidirectional instability.

Biomechanical studies have shown that the rate of speed of injury may determine where the capsule is injured. Faster strain rates tend to cause more ligament intrasubstance injury, and slower strain rates tend to cause a failure at the ligament insertion site. Arthroscopic studies have documented that some degree of capsular injury is present in almost all patients after an acute shoulder dislocation. The shoulder capsule tends to be lax and patulous in patients with symptomatic multidirectional instability.Correct Answer: The shoulder capsule tends to be tight in patients with multidirectional instability.

3103. (2686) Q7-3179:

Which of the following is not considered a mechanism of injury for a superior labrum anterior and posterior (SLAP) tear:

1) Traction injury from carrying, dropping, or lifting a heavy object
3) Repetitive overhead throwing
2) Compression force from a fall on an outstretched arm
5) External rotation movement with returning a backhand in tennis
4) Forceful biceps contraction with throwing a ball or spiking a volleyball

The other mechanisms of injury have been reported in patients with documented SLAP tears. The series reported by Snyder and colleagues reported that a compressive force from a fall on an outstretched arm was the most common mechanism of injury. However in their study, 21% of the patients with a SLAP lesion reported an insidious onset to their symptoms. Maffet and colleagues reported that two-thirds of patients described a traction injury as the initial traumatic event. In their study, only 8% of patients sustained a fall on their outstretched arm. Most throwing athletes examined by Andrews and colleagues failed to report a distinct traumatic event. Thus, while an isolated injury may cause a labral injury, SLAP lesions also may occur as a result of the repetitive microtrauma associated with overhead motions.Correct Answer: External rotation movement with returning a backhand in tennis

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3104. (2687) Q7-3180:

The belly press test is used in testing the integrity of which of the following structures:

1) The abdominal muscles
3) The subscapularis tendon
2) The supraspinatus tendon
5) The teres minor tendon
4) The infraspinatus tendon

The subscapularis is tested using the belly press test and lift-off test. The supraspinatus is tested using the Jobe test. The infraspinatus is tested with the external rotation lag sign and by testing external rotation strength with the arm at the side. The teres minor is tested using the horn blowerâs sign.Correct Answer: The subscapularis tendon

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3105. (2688) Q7-3181:

The lift-off test is used in testing the integrity of which of the following structures:

1) The abdominal muscles
3) The subscapularis tendon
2) The supraspinatus tendon
5) The teres minor tendon
4) The infraspinatus tendon

The subscapularis is tested using the belly press test and lift-off test. The supraspinatus is tested using the Jobe test. The infraspinatus is tested with the external rotation lag sign and by testing external rotation strength with the arm at the side. The teres minor is tested using the horn blowerâs sign.Correct Answer: The subscapularis tendon

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3106. (2807) Q7-3305:

Surferâs ear is characterized by:

1) Injury of the ears while surfing
3) Damage of ear cartilage
2) Middle ear inflammation
5) None of the above
4) Exostosis of the external acoustic meatus

Many sports have associated injuries, for instance there is the tennis elbow, skier's thumb, and boxer's ear. For the sport of surfing there is a condition known as surfer's ear. This injury involves an exostosis of the external acoustic meatus with obstructions of differing degrees.

A study of 51 surfing professionals was conducted in Japan to determine the frequency of surfer's ear. Study participants surfed approximately 300 days per year and were an average of 26 years of age. It was found that 41 of the 51 surfers (80%) had surfer's ear. Nineteen of the 51 surfers (37%) were identified as having more than a 50% stenosis of the external acoustic meatus in 30 ears.

Correct Answer: Exostosis of the external acoustic meatus

3107. (2891) Q7-3392:

Lateral epicondylitis of the elbow is more common than medial epicondylitis in all of the following populations except:

1) Tennis players
3) Plumbers
2) Electricians
5) Tailors
4) Golfers

Lateral epicondylitis is a pathological condition involving the origin of the common extensors (extensor carpi radialis longus, extensor carpi radialis brevis, extensor carpi digitorum communis, and extensor carpi ulnaris); hence, any activity, whether recreational or occupational, involving repetitive stressing of the wrist extensors makes an individual susceptible to lateral epicondylitis. In addition to tennis, other sports implicated in the development of lateral epicondylitis include baseball and associated sports involving throwing activities, fencing, martial arts, and swimming. Occupations particularly prone to development of lateral epicondylitis often involve tedious repetitive activities requiring manual dexterity such as electronics repair, plumbing, and tailoring. Medial epicondylitis is more common than lateral epicondylitis in golfers.Correct Answer: Golfers

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3108. (2892) Q7-3393:

What is the approximate lifetime prevalence of lateral epicondylitis of the elbow in avid tennis players:

1) 10%
3) 50%
2) 30%
5) 95%
4) 70%

Although the overall incidence of lateral epicondylitis in the general population is unclear, approximately 50% of avid tennis players will experience this condition during their lifetime. The condition usually occurs during the fourth or fifth decade, but can occur across a broad spectrum of ages, and affects men and women indiscriminately.Correct Answer: 50%

3109. (2893) Q7-3394:

Which of the following is the most commonly injured joint in childhood sports:

1) Ankle
3) Hip
2) Elbow
5) Knee
4) Shoulder

The knee is the most commonly injured joint in childhood sports. With the increasing participation of children in competitive athletics, midsubstance disruption of the anterior cruciate ligament (ACL) in skeletally immature individuals is becoming more common. Additionally, increasing awareness of this injury and improved imaging modalities have made ACL injuries more readily recognizable in the pediatric population.Correct Answer: Knee

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3110. (2894) Q7-3395:

Subacromial impingement syndrome typically affects patients in which decade of life:

1) 1st
3) 5th
2) 3rd
5) 9th
4) 7th

Patients with subacromial impingement syndrome are usually older than 40 years of age with a chief complaint of shoulder pain. Patients often recall no specific injury to their shoulder, but onset of pain may be related to a recent increase in overhead activity following a period of relative inactivity. Pain initially only occurs with overhead use of the arm but may progress to persistent pain with any use of the arm or even nighttime pain in extreme cases. The dominant extremity is more often affected by virtue of increased utilization.Correct Answer: 5th

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3111. (2895) Q7-3396:

Which of the following is the most commonly dislocated joint in the body:

1) Elbow
3) Hip
2) Shoulder
5) Ankle
4) Knee

The shoulder is the most commonly dislocated major joint in the body, with the incidence of traumatic anterior shoulder dislocation approaching 2%. Traumatic recurrent anterior shoulder instability can also take the form of recurrent subluxation or simply a chronically painful shoulder without a defined history of dislocation.Correct Answer: Shoulder

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3112. (2896) Q7-3397:

What percentage of patients with recurrent anterior shoulder instability has an identifiable abnormality on plain radiography:

1) 10%
3) 75%
2) 25%
5) 95%
4) 85%

Plain radiography can yield osseous abnormalities in up to 95% of shoulders with chronic traumatic anterior shoulder instability, including 75% with humeral head impaction fractures and 85% with a bony glenoid lesion. Bony glenoid lesions include a frank fracture, which can be identified on an anteroposterior view or a glenoid profile view; loss of normal contour of the anterior glenoid rim caused by multiple microimpaction fractures of the anterior glenoid; or a complete bony deficiency of the anterior glenoid caused by resorption of a fracture fragment. Osseous abnormalities are most common in shoulders that have a history of prior dislocation and least common in shoulders that are simply painful with no established history of dislocation or subluxation.Correct Answer: 95%

3113. (2897) Q7-3398:

What percentage of patients with recurrent anterior shoulder instability has an identifiable humeral head abnormality on plain radiography:

1) 10%
3) 75%
2) 25%
5) 95%
4) 85%

Plain radiography can yield osseous abnormalities in up to 95% of shoulders with chronic traumatic anterior shoulder instability, including 75% with humeral head impaction fractures and 85% with a bony glenoid lesion. Bony glenoid lesions include a frank fracture, which can be identified on an anteroposterior view or a glenoid profile view (Figure 8); loss of normal contour of the anterior glenoid rim caused by multiple microimpaction fractures of the anterior glenoid; or a complete bony deficiency of the anterior glenoid caused by resorption of a fracture fragment. Osseous abnormalities are most common in shoulders that have a history of prior dislocation and least common in shoulders that are simply painful with no established history of dislocation or subluxation.Correct Answer: 75%

3114. (2898) Q7-3399:

What percentage of patients with recurrent anterior shoulder instability has an identifiable glenoid abnormality on plain radiography:

1) 10%
3) 75%
2) 25%
5) 95%
4) 85%

Plain radiography can yield osseous abnormalities in up to 95% of shoulders with chronic traumatic anterior shoulder instability, including 75% with humeral head impaction fractures and 85% with a bony glenoid lesion. Bony glenoid lesions include a frank fracture, which can be identified on an anteroposterior view or a glenoid profile view; loss of normal contour of the anterior glenoid rim caused by multiple microimpaction fractures of the anterior glenoid; or a complete bony deficiency of the anterior glenoid caused by resorption of a fracture fragment. Osseous abnormalities are most common in shoulders that have a history of prior dislocation and least common in shoulders that are simply painful with no established history of dislocation or subluxation.Correct Answer: 85%

3115. (2899) Q7-3400:

Which of the following represents the most common scenario of injury resulting in athletic pubalgia:

1) Repetitive hyperextension of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis in a female athlete
3) A single forced hyperextension of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis in a female athlete
2) Repetitive hyperextension of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis in a male athlete
5) A single forced hyperflexion of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis in a male athlete
4) A single forced hyperextension of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis in a male athlete

The rectus insertion on the pubis with or without the origin of the adductor longus tendon appears to be the primary site of pathology. Athletic pubalgia has been described primarily in high-level athletes and almost exclusively in men. The proposed mechanism of injury involves repetitive hyperextension of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis.Correct Answer: Repetitive hyperextension of the trunk in association with hyperabduction of the thigh pivoting on the anterior pelvis and pubic symphysis in a male athlete

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3116. (2935) Q7-3438:

Medial tibial stress syndrome most commonly occurs in which of the following locations:

1) Lateral tibia
3) Superior and middle thirds of the posteromedial tibia
2) Superior third of the posteromedial tibia
5) Medial malleolus
4) Middle and inferior thirds of the posteromedial tibia

Medial tibial stress syndrome most commonly occurs over the middle and inferior thirds of the medial tibia and is generally localized to an area 4 cm proximal to the medial malleolus, extending to the junction of the middle and superior aspect of the posteromedial tibia.Correct Answer: Middle and inferior thirds of the posteromedial tibia

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3117. (2936) Q7-3439:

The skeletal pathology most often associated with medial tibial stress syndrome is:

1) Varus alignment of the knee
3) Forefoot pronation
2) Valgus alignment of the knee
5) Cavus deformity of the foot
4) Forefoot supination

Medial tibial stress syndrome is generally associated with activity changes or overuse. However, some evidence points to an increased incidence in patients who have excessive forefoot pronation. Orthotics can be used to reduce forefoot pronation.Correct Answer: Forefoot pronation

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3118. (2937) Q7-3440:

Which of the following is the most common theory for the pathophysiology of medial tibial stress syndrome:

1) Medial tibial stress syndrome is a variant of chronic compartment syndrome.
3) Medial tibial stress syndrome is a stress fracture.
2) Increased pressure in the anterior compartment causes pain.
5) Medial tibial stress syndrome is a variant of chronic regional pain syndrome.
4) A stress response in the bone results in osteoclastic remodeling that can cause pain.

Medial tibial stress syndrome is thought to be a stress response in the bone. The bone is resorbed by osteoclasts in the process of remodeling. Resorption is a direct response to excessive stress applied by overuse. The bone is then replaced by osteoblastic activity.Correct Answer: A stress response in the bone results in osteoclastic remodeling that can cause pain.

3119. (2938) Q7-3441:

Which of the following is a major finding on physical examination for an athlete with medial tibial stress syndrome:

1) Increased pressure in the anterior compartment 5 minutes after exercise
3) Pain with passive ankle range of motion
2) Pain with passive knee range of motion
5) Tenderness to palpation over the anteromedial border of the tibia
4) Tenderness to palpation over the posteromedial border of the tibia

Patients with medial tibial stress syndrome often have most of their pain over the posteromedial border of the tibia. Pain is elicited with direct palpation. Palpation of other portions of the tibia should not cause pain. Occaionally, patients will have pain with resisted ankle range of motion, but not with passive ankle or knee motion.Correct Answer: Tenderness to palpation over the posteromedial border of the tibia

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3120. (2939) Q7-3442:

What is the most common radiographic finding for a patient with medial tibial stress syndrome:

1) Normal radiographs
3) Traction osteophytes of medial malleolus
2) Osteopenia of the mid to distal tibia
5) Diffuse thickening of the tibial cortex circumferentially
4) Lucent horizontal line extending from the medial cortex

The most common radiographic finding in a patient with medial tibial stress syndrome is a normal radiograph. Occasionally, hypertrophy of the posteromedial tibial cortex may be present. This hypertrophy is not circumferential. Lucent lines are indicative of a stress fracture. Osteopenia and traction osteophytes do not play a role in medial tibial stress syndrome.Correct Answer: Normal radiographs

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3121. (2940) Q7-3443:

What are the main findings of medial tibial stress syndrome on a bone scan:

1) Delayed uptake of tracer and nonfocal uptake over the posteromedial tibial border
3) Focal uptake of tracer in early phase only
2) Lack of uptake of tracer in all phases
5) Nonspecific uptake of tracer in all phases
4) Focal uptake of tracer in delayed phases

Medial tibial stress syndrome has a characteristic finding on bone scan of uptake only in the delayed phase. Uptake is nonfocal and is along the posteromedial border of the tibia. These findings contrast with a stress fracture, which has focal uptake in the early phase.Correct Answer: Delayed uptake of tracer and nonfocal uptake over the posteromedial tibial border

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3122. (2941) Q7-3444:

The primary intervention for patients with medial tibial stress syndrome is:

1) Surgery with release of the posteromedial fascia
3) Viscosupplementation of the knee
2) Cortisone injections at the insertion of the soleus on the posteromedial tibia
5) Increasing activities until pain subsides
4) Activity modification, icing after activities, and nonsteroidal anti-inflammatory medication

Most cases of medial tibial stress syndrome resolve with relative rest and icing after activities. Nonsteroidal anti-inflammatory medications may also be useful. Cortisone injections and viscosupplementation do not play a role in medial tibial stress syndrome. Surgery for medial tibial stress syndrome includes release of the soleus fascia; however, surgery is rarely indicated.Correct Answer: Activity modification, icing after activities, and nonsteroidal anti-inflammatory medication

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3123. (2942) Q7-3445:

What is the most common site of pelvic avulsion fracture in a skeletally immature athlete:

1) Anterior inferior iliac spine (AIIS)
3) Anterior superior iliac spine (ASIS)
2) Ischial tuberosity
5) Pubic symphysis
4) Iliac crest

The most common site of a pelvic avulsion fracture in a skeletally immature athlete is the ischial tuberosity. A pelvic avulsion fracture in a skeletally immature patient is the equivalent of a proximal hamstring injury in an adult. The second most common injuries are to the AIIS and ASIS. Injuries also occur to the pubic symphysis and iliac crest, but they are less common.Correct Answer: Ischial tuberosity

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3124. (2943) Q7-3446:

Which of the following muscle origins is responsible for an avulsion injury of the anterior inferior iliac spine (AIIS) in a skeletally immature athlete:

1) Sartorius
3) Rectus femoris
2) Adductor magnus
5) External oblique
4) Semimembranosus

The rectus femoris originates from the AIIS and is responsible for avulsion injuries to the AIIS in skeletally immature athletes. The sartorius originates from the anterior superioe iliac spine. The adductor magnus originates from the pubic symphysis and infrapubic tubercle. The semimembranosus originates from the ischial tuberosity. The external oblique inserts on the iliac crest.Correct Answer: Rectus femoris

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3125. (2944) Q7-3447:

What are the muscle actions of the sartorius on the hip and knee joints:

1) Hip extension, knee flexion
3) Hip extension, knee extension
2) Hip flexion, knee extension
5) Hip flexion, knee flexion
4) Hip external rotation, knee extension

The sartorius crosses the hip and knee joints, crossing the hip anteriorly and the knee posterior to its axis of rotation. Therefore, the sartorius flexes the hip and flexes the knee.Correct Answer: Hip flexion, knee flexion

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3126. (2945) Q7-3448:

Which myotendinous junction is the most common site for proximal hamstring injury:

1) Semimembranosus
3) Biceps femoris
2) Semitendinosus
5) Gracilis
4) Rectus femoris

The biceps femoris proximal musculotendinous junction is the most commonly injured muscle in proximal hamstring injuries. The other hamstring muscles that take their origin from the ischium are the semitendinosus and semimembranosus. The rectus femoris and gracilis take their origins from the anterior inferior iliac spine and anterior superior iliac spine, respectively.Correct Answer: Biceps femoris

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3127. (2946) Q7-3449:

Greater trochanteric bursitis is most common among:

1) Female runners
3) Female tennis players
2) Male runners
5) Male baseball players
4) Male skiers

Trochanteric bursitis is common in female runners, likely due to their broad-based pelvis as compared to their male counterparts. Some runners may identify a causative factor in their symptoms such as an increase in their mileage or an increase in the level of difficulty of their training course. Additionally, if running is done on the road, often one leg will be affected. This leg is generally the leg on the outer side of the road and is affected by the drainage slope incorporated into the design of roads. Other provocative activities include lying on the affected side.Correct Answer: Female runners

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3128. (2953) Q7-3458:

The most common cause of an indirect injury to the Lisfranc joint occurs through which mechanism:

1) Compression
3) Axial load of a plantarflexed foot
2) Hyperdorsiflexion
5) Pronation and adduction
4) Supination and external rotation

The indirect mechanism of injury involves axial loading of a plantarflexed foot. This type of mechanism is commonly cited in soccer, basketball, and gymnastics. The most frequent pattern in the indirect mechanism is failure of the weaker dorsal tarsometatarsal ligaments in tension with dorsal dislocation of the metatarsals.Correct Answer: Axial load of a plantarflexed foot

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3129. (2954) Q7-3460:

Slide 1

A 19-year-old college gymnast fell off the balance beam during competition, sustaining an injury to her right foot. She presents to your office, and a radiograph (Slide) is obtained. What is the preferred method of treatment to optimize her result:

1) Closed reduction and short leg non-weight bearing cast
3) Closed reduction and percutaneous pinning
2) Closed reduction and short leg walking cast
5) Observation
4) Open reduction and internal fixation

According to investigators, a displacement of more than 2 mm requires open reduction and internal fixation to avoid a poor outcome, especially in athletes. While some orthopedists prefer closed fixation with percutaneous K-wires, others report that this method does not hold anatomic reduction and fixation. An alternative method involves the use of open reduction and internal fixation with AO screw fixation. An open surgical field allows easier removal of fragments or soft tissue that may be hindering reduction of the dislocation.Correct Answer: Open reduction and internal fixation

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3130. (3175) Q7-3994:

The triceps tendon insertion has two well-defined components. The triceps proper inserts:

1) Directly onto the posterior 40% of the olecranon
3) On to the entirety of the olecranon tip
2) On to the anconeous muscle
5) None of the above
4) On to the anterior aspect of the olecranon

A thorough understanding of the insertional anatomy of the extensor mechanism of the elbow is essential in understanding the treatment principle for chronic triceps tendonitis in throwers. Approximately 20 cm proximal to the olecranon tip, the triceps tendon originates from within the body of the triceps muscle. Two components of the triceps extensor mechanism form as the tendon approaches its insertion on the olecranon tip. The triceps thickened proper inserts directly onto the posterior 40% of the tip of the olecranon. The relatively thin triceps expansion inserts distally and laterally primarily through the anconeus. The triceps decussation, which is well defined in 50% of specimens, is a well-defined interval located between the triceps proper and the triceps expansion.Correct Answer: Directly onto the posterior 40% of the olecranon

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3131. (3432) Q7-4348:

Which of the following is necessary for optimal tendon-bone healing:

1) No sling postoperatively
3) Open technique
2) Accelerated physical therapy
5) Loose approximation of tissues
4) Decreased motion at the bone-tendon junction

Factors involved in optimal tendon-to-bone healing include footprint coverage, contact pressure, suture strength, loop and knot security, and decreased motion at the bone-tendon junction. Gerber and colleagues suggested that the ideal repair provides high initial fixation strength, minimizes gap formation, and maintains mechanical stability until sufficient healing has occurred.Correct Answer: Decreased motion at the bone-tendon junction

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3132. (3433) Q7-4353:

Postoperatively, an intact rotator cuff correlates with which physical examination finding:

1) More pain
3) Less stiffness
2) More strength in external rotation and forward elevation
5) Better patient satisfaction
4) Less stability

Previous studies showed no significant difference in functional or pain scores based on tendon integrity, but strength in forward elevation and external rotation were significantly correlated with an intact repair. Patient satisfaction is not significantly associated with an intact tendon repair.Correct Answer: More strength in external rotation and forward elevation

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3133. (3465) Q7-4401:

An 18-year-old soccer player sustains an injury to his foot. He described the injury as axial loading of a plantarflexed foot. He presents with a swollen and painful foot and is unable to put weight on his limb. After an initial radiograph, what is the next study you would obtain:

1) Computed tomography scan
3) Oblique radiograph
2) Sress radiographs with the forefoot in dorsiflexion and abduction
5) Bone scan
4) Magnetic resonance image

Standing radiographs are ideal but often times too painful. A good alternative is stress radiographs with the forefoot in dorsiflexion and abduction. On the radiographs, dislocation of the tarsometatarsal joint is indicated by the following: loss of in-line arrangement of the lateral margin of the first metatarsal base with the lateral edge of the medial cuneiform, loss of in-line arrangement of the medial margin of the second metatarsal base with the medial edge of the middle cuneiform in the weight bearing anteroposterior view, and the presence of small avulsed fragments (fleck sign), which are further indications of ligamentous injury and probable joint disruption.Correct Answer: Sress radiographs with the forefoot in dorsiflexion and abduction

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3134. (3478) Q7-4417:

L-shaped tears differ from crescent shaped tears because L-shaped tears:

1) Violate the anterior (or posterior) attachment of the supraspinatus
3) Are always more mobile
2) Must involve at least 2 tendons
5) Are never acute
4) Are less likely to retract more medial to the glenoid

Crescent, L-shaped, and reverse L-shaped tears comprise approximately 90% of all tears, and although they may become large, they are usually mobile and rarely retract medial to the glenoid. The crescent tear is different from an L- or reverse-L shaped tear because it does not violate either the anterior or posterior attachment of the supraspinatus tendon to the greater tuberosity. L-shaped tears can have either an anterior or posterior flap (reverse-L) and require similar surgical considerations to the U-shaped tear.Correct Answer: Violate the anterior (or posterior) attachment of the supraspinatus

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3135. (3483) Q7-4423:

Approximately how much of the native supraspinatus footprint can be restored using single-row suture anchor fixation:

1) 5%
3) 50%
2) 20%
5) 95%
4) 80%

In vivo examination of the footprint showed that with a single lateral row of suture anchors, 47% of the footprint was reestablished and, with the addition of a medial row, the entire footprint was reestablished.Correct Answer: 50%

3136. (3491) Q7-4433:

The Lisfranc ligament passes between which two bony structures:

1) Medial cuneiform and second metatarsal
3) Medial cuneiform and first metatarsal
2) Middle cuneiform and first metatarsal
5) Middle cuneiform and second metatarsal
4) Lateral cuneiform and first metatarsal

The proximal end of the second metatarsal is recessed between the medial and lateral cuneiform. This mortise configuration locks the tarsometatarsal complex. No ligament binds the first and second metatarsal. The main stabilizer of this relationship is the Lisfranc ligament. The Lisfranc ligament is a strong oblique ligament that extends from the plantar-lateral aspect of the medial cuneiform and inserts into the plantar medial second metatarsal.Correct Answer: Medial cuneiform and second metatarsal

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3137. (3506) Q7-4458:

What has been identified as a significant risk factor for re-tear of a primary supraspinatus tendon repair:

1) Original tear >3 cm in size
3) Age ≤50
2) Dominant extremity
5) Male gender
4) Immobilization

When stratified based on original tear size, repair of a tear >3 cm in size had a seven times greater likelihood for re-tear.Correct Answer: Original tear >3 cm in size

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3138. (3507) Q7-4459:

The maximal contraction force generated by the supraspinatus muscle is approximately:

1) 3 N
3) 300 N
2) 30 N
5) 5000 N
4) 3000 N

Based on the average cross-sectional area of the supraspinatus muscle and the maximal contraction of muscle per unit area, Burkhart determined that the maximal contraction force generated by the supraspinatus is equal to approximately 302 N.Correct Answer: 300 N

3139. (3539) Q7-4493:

What is the main functional deficit after distal biceps tendon ruptures:

1) Loss of extension strength only
3) Loss of extension strength and supination strength
2) Loss of flexion strength only
5) Loss of supination strength only
4) Loss of flexion strength and supination strength

The main functional deficit after biceps tendon rupture is a 40% loss of supination strength, 47% loss of supination endurance, and a 21% to 30% loss of flexion strength at the elbow when compared to the uninjured extremity.Correct Answer: Loss of flexion strength and supination strength

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3140. (3540) Q7-4494:

Which of the following patients is the least ideal candidate for surgical treatment of a distal biceps rupture:

1) A 45-year-old mechanic
3) A 57-year-old firefighter
2) A 40-year-old professional weight lifter
5) A 53-year-old retiree with rheumatoid arthritis
4) A 28-year-old Olympic pole vaulter

Surgical treatment of distal biceps injury re-establishes flexion and supination strength that is essential in laborers, athletes, and weight lifters. A 53-year-old male retiree with rheumatoid arthritis is unlikely to be active enough to benefit from surgical intervention.Correct Answer: A 53-year-old retiree with rheumatoid arthritis

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3141. (3541) Q7-4495:

Which complication is associated with the anterior one-incision surgical approach for distal biceps tendon repair:

1) Radial nerve injury
3) Radioulnar synostosis
2) Heterotopic ossification
5) Median nerve Injury
4) Ulnar nerve injury

The radial nerve can be injured during the anterior one-incision approach to the elbow. To avoid this injury, maintain supination of the forearm during dissection of the radial tuberosity.Correct Answer: Radial nerve injury

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3142. (3542) Q7-4496:

Which fixation device used during repair of the distal biceps tendon has shown the greatest load to failure:

1) Interference screw
3) Transosseous bone tunnel technique
2) EndoButton (Smith and Nephew, Andover, Mass)
5) Suture anchor and interference screw combination technique
4) Suture anchors

In a study by Mazzocca and colleagues, the EndoButton had the highest load to failure when compared to interference screws, a bone tunnel technique, and suture anchors.Correct Answer: EndoButton (Smith and Nephew, Andover, Mass)

3143. (3543) Q7-4497:

What is the main risk associated with the two-incision approach for distal biceps tendon repair:

1) Median nerve injury
3) Radioulnar synostosis
2) Radial tuberosity fracture
5) Transient ulnar neuropathy
4) Radial nerve injury

The Boyd and Anderson two-incision technique has classically been associated with heterotopic ossification leading to radioulnar synostosis. This approach has been modified to a muscle-splitting approach, limiting periosteal dissection and decreasing the risk of heterotopic ossification.Correct Answer: Radioulnar synostosis

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3144. (3544) Q7-4498:

Using a one-incision anterior surgical approach, an acute distal biceps tendon rupture should be repaired:

1) Nonanatomically to the underlying brachialis muscle with the arm in neutral rotation
3) Anatomically to the ulnar aspect of the radial tuberosity with the arm pronated
2) Anatomically to the radial aspect of the radial tuberosity with the arm pronated
5) Anatomically to the radial aspect of the radial tuberosity with the arm supinated
4) Anatomically to the ulnar aspect of the radial tuberosity with the arm supinated

The distal biceps tendon attaches in a ribbon-like fashion to the ulnar aspect of the radial tuberosity. During the anterior approach, the arm should be held in supination to avoid the radial nerve.Correct Answer: Anatomically to the ulnar aspect of the radial tuberosity with the arm supinated

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3145. (3545) Q7-4499:

A 46-year-old plumber ruptured the distal biceps tendon in his dominant extremity 8 months ago. He was treated initially with 1 week of immobilization followed by a short course of physical therapy. He states he feels very fatigued at the end of the day and that easy tasks are taking him longer than normal to complete. What is the best treatment option for this patient:

1) Nonoperative treatment consisting of aggressive physical and occupational therapy focusing on elbow and wrist stretching and strengthening exercises
3) Anatomic primary repair via a two-incision posterior approach
2) Anatomic primary repair via an anterior one-incision approach
5) Anatomic reconstruction using a posterior tibial tendon autograft via a two-incision posterior approach
4) Anatomic reconstruction using a semitendinosus autograft via a one-incision anterior approach

This laborer has a chronic distal biceps tendon rupture, which is affecting his job. Reconstruction with autograft (or allograft) supplementation over primary repair is indicated as his biceps tendon is likely retracted and scarred down. The technique of reconstruction of a chronic distal biceps tendon reconstruction with a semitendinosus autograft using a single-incision technique has been described yielding excellent results. Use of a posterior tibial tendon autograft has not been described.Correct Answer: Anatomic reconstruction using a semitendinosus autograft via a one-incision anterior approach

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3146. (3665) Q7-7442:

The most common type of femoroacetabular impingement is:

1) Pincer type
3) Combined (both pincer and cam)
2) Cam type
5) Dysplasia
4) Retroversion

The most common type of femoroacetabular impingement is the combined cam and pincer type.Correct Answer: Combined (both pincer and cam)

3147. (3666) Q7-7443:

Which of the following is not an indication for hip arthroscopy:

1) Loose body
3) Femoroacetabular impingement
2) Labral tear
5) Infection
4) Osteoarthritis

Osteoarthritis is not an indication for hip arthroscopy. While there may be a limited role for arthroscopic intervention in specific patients, generally, advanced osteoarthritis is best treated with arthroplasty options.Correct Answer: Osteoarthritis

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3148. (3667) Q7-7444:

The portal with greatest risk to the lateral femoral cutaneous nerve is the:

1) Anterior paratrochanteric portal
3) Direct anterior portal
2) Posterior paratrochanteric portal
4) Mid-anterior (accessory anterolateral) portal

Lateral femoral cutaneous nerve palsy is one of the more common complications of hip arthroscopy and has been attributed to its proximity to the anterior portal.Correct Answer: Direct anterior portal

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3149. (3668) Q7-7445:

The nerve that is most commonly compressed as the result of traction over a perineal post is:

1) Sciatic
3) Peroneal
2) Superior gluteal
5) Pudendal
4) Lateral femoral cutaneous

The pudental nerve is commonly injured from compression against a perineal post, resulting in sensory loss to the genitalia.Correct Answer: Pudendal

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3150. (3669) Q7-7446:

All of the following are noted advantages of the supine position compared to the lateral position, except:

1) Familiar orientation for most surgeons
3) Shorter positioning time
2) Can be performed on standard fracture table
4) Easier for obese patients

The first 3 listed statements are true advantages of the supine position, while the ease of arthroscopy in obese patients is a noted advantage of the lateral position during hip arthroplasty, as the panniculus and buttock fall away from the operative field.Correct Answer: Easier for obese patients

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3151. (3774) Q7-7556:

Which physical examination finding is most consistent in a patient with adhesive capsulitis:

1) Loss of active range of motion
3) Loss of internal rotation
2) Loss of passive and active range of motion
5) Loss of strength
4) Loss of abduction

The physical examination and history are the keys to early diagnosis and treatment. Adhesive capsulitis involves a loss of active and passive range of motion. Patients with rotator cuff tears may lose active range of motion, but passive range of motion is usually preserved.

Correct Answer: Loss of passive and active range of motion

3152. (3775) Q7-7557:

An intra-articular corticosteroid injection is most effective during this stage of adhesive capsulitis:

1) Stage 1 and 2
3) Stage 3 and 4
2) Stage 2 and 3
5) A diagnostic, local anesthetic injection is more useful.
4) An intra-articular corticosteroid injection is never effective in relieving adhesive capsulitis.

An intra-articular corticosteroid injection prior to the onset of significant fibrosis can alter the progression of adhesive capsulitis.

Correct Answer: Stage 1 and 2

3153. (3776) Q7-7558:

What is the expected outcome with nonoperative treatment of adhesive capsulitis:

1) All symptoms and signs resolve with no residual effects.
3) Patients have pain with overhead activity and subacromial impingement but regain full range of motion.
2) Patients are always pain free but typically lose 50% of their range of motion.
5) Nonoperative treatment is ineffective and arthroscopic or open capsular release is recommended.
4) Approximately 75% to 90% of patients are satisfied with nonoperative treatment and regain about 80% active range of motion compared to their unaffected shoulder.

Although the original descriptions of frozen shoulder and adhesive capsulitis suggest the course is benign and self-limiting, studies by Shaffer and colleagues and Griggs and researchers suggest that while most patients do well, 10% to 25% of patients still have some pain or loss of motion.

Correct Answer: Approximately 75% to 90% of patients are satisfied with nonoperative treatment and regain about 80% active range of motion compared to their unaffected shoulder.

3154. (3777) Q7-7559:

Which of the follow groups are expected to have a higher incidence of recurrent adhesive capsulitis and more residual symptoms after nonoperative treatment:

1) Men and patients with diabetes
3) Men and idiopathic
2) Women and posttraumatic
5) Women and patients with diabetes
4) Women and hyperthyroidism

Men are afflicted with adhesive capsulitis less commonly than women. Diabetes is one of the most common conditions to be found in conjunction with adhesive capsulitis. Studies such as that by Ogilvie-Harris and colleagues suggest that men and patients with diabetes are the most resistant to nonoperative treatment.

Correct Answer: Men and patients with diabetes

3155. (3778) Q7-7560:

How is adhesive capsulitis differentiated from rotator cuff tears as a cause of shoulder pain:

1) The symptoms are identical; magnetic resonance imaging is needed to evaluate the rotator cuff.
3) A subacromial injection allows full range of motion for all stages of adhesive capsulitis.
2) Subacromial injection relieves the majority of pain related to rotator cuff tear, but the patient may still experience weakness if the tear is significantly large.
5) Patients are weak and cannot lift their arm above the shoulder with both adhesive capsulitis and rotator cuff tears.
4) Oral corticosteroids relieve the symptoms of rotator cuff tears.

This is perhaps the most critical early clinical diagnostic challenge when treating a patient complaining of a stiff or weak painful shoulder. While an intra-articular injection is helpful in the early treatment of adhesive capsulitis, a subacromial injection (such as that used with the impingement test), can help differentiate the two diagnoses.

Correct Answer: Subacromial injection relieves the majority of pain related to rotator cuff tear, but the patient may still experience weakness if the tear is significantly large.

3156. (3882) Q7-7761:

What is the most common reason for technical failure after anterior cruciate ligament (ACL) reconstruction:

1) Loss of fixation
3) Improper tensioning
2) Improper tunnel placement
5) Inadequate notchplasty
4) Insufficient graft harvest

Improper tunnel position is a commonly recognized technical error and reason for graft failure after ACL reconstruction. Tunnel malposition may result in limited range of motion, impingement, and excessive graft tension.

Correct Answer: Improper tunnel placement

3157. (3883) Q7-7762:

Which of the following is a cause for recurrent instability after anterior cruciate ligament (ACL) reconstruction within the first 6 months postoperative:

1) Technical error
3) Insufficient graft
2) Unrecognized patholaxity
4) All of the above

Insufficient graft, unrecognized patholaxity, and technical error including improper tunnel placement, fixation failure, and improper graft tensioning are common causes for early recurrent instability and poor outcomes.

Correct Answer: All of the above

3158. (3884) Q7-7763:

What is the most sensitive radiographic tool to assess for tunnel osteolysis preoperatively:

1) Standing anteroposterior radiographs
3) Computed tomography
2) Standing lateral radiographs
4) Magnetic resonance imaging

Computed tomography (CT) is a useful tool in preoperative planning for revision anterior cruciate ligament surgery. A CT scan helps delineate tunnel position, integrity, and expansion especially in the setting of a previous soft tissue or synthetic graft.

Correct Answer: Computed tomography

3159. (3885) Q7-7764:

A vertically placed femoral tunnel as shown (Slide) may have what affect on knee biomechanics:

1) Translational control only
3) Negative Lachman examination
2) Rotational control only
5) A and C
4) Negative pivot shift examination

A vertically oriented graft may resist translation and thereby have a negative Lachman examination. However, vertical graft placement does not adequately control rotation and patients will often experience persistent instability and a positive pivot shift on examination.

Correct Answer: A and C

3160. (3886) Q7-7765:

When planning the tibial tunnel, the variable angle tibial aimer should create what angle with the long axis of the tibia to ensure proper tunnel obliquity:

1) 5Â°
3) 20Â°
2) 10Â°
5) 50Â°
4) 30Â°

A tibial tunnel reamed 30Â° relative to the long axis of the tibia will create an appropriate medial to lateral oblique orientation, which permits an anatomic femoral tunnel position when using a transtibial technique.

Correct Answer: 30Â°

3161. (4002) Q7-8254:

The most important divisions of the acromioclavicular (AC) ligament in the prevention of translation are the:

1) Anterior and superior divisions
3) Anterior and inferior divisions
2) Posterior and superior divisions
5) None of the above
4) Posterior and inferior divisions

The acromioclavicular (AC) ligament has superior, inferior, anterior, and posterior divisions. The AC ligaments provide stability in all planes when exposed to small forces. However, with larger forces, their major contribution is to resist displacement in the anterior-posterior plane. Klimkiewicz and associates reported that the superior and posterior divisions of the AC ligament are the most important for preventing posterior translation of the clavicle and abutment against the scapular spine.

Correct Answer: Posterior and superior divisions

3162. (4008) Q7-8260:

Which anterior cruciate ligament graft material has the highest ultimate tensile load:

1) Bone-patellar tendon-bone
3) Achilles tendon
2) Four-strand hamstring tendons
5) Anterior tibialis tendon
4) Central third quadriceps tendon

Of the listed graft options, quadruple hamstrings possess the greatest ultimate tensile load (4090 N) and stiffness (776 N/mm). Bone-patellar tendon-bone grafts have an ultimate tensile load of 2977 N and a stiffness of 620 N/mm. Quadriceps tendon grafts have an ultimate tensile load of 2352 N and a stiffness of 463 N/mm.

Correct Answer: Four-strand hamstring tendons

3163. (4009) Q7-8261:

Which anterior cruciate ligament graft material will most quickly incorporate into host bone:

1) Four-strand hamstring tendon allograft
3) Bone-patellar tendon-bone allograft
2) Four-strand hamstring tendon autograft
5) Achilles tendon allograft
4) Bone-patellar tendon-bone autograft

Bone-patellar tendon-bone grafts heal to host bone within 6 weeks, while the other soft tissue grafts may require 8 to 12 weeks for incorporation into host bone. Although autografts and allografts follow the same sequence of incorporation into host bone, allografts have a slower rate of incorporation. Patellar tendon allograft tissue has demonstrated increased vascularity and inflammatory response, decreased cross-sectional area, less collagen remodeling, and increased anteroposterior translation than patellar tendon autograft at 6 weeks and 6 months following transplantation.

Correct Answer: Bone-patellar tendon-bone autograft

3164. (4011) Q7-8263:

A 20-year-old running-back at a Division I university ruptures his anterior cruciate ligament (ACL) during a game. What is the preferred graft material for his ACL reconstruction:

1) Bone-patellar tendon-bone allograft
3) Four-strand hamstring tendon allograft
2) Four-strand hamstring tendon autograft
5) Bone-patellar tendon-bone autograft
4) Quadriceps tendon autograft

Autograft is the appropriate graft in this patient, as opposed to an allograft. The bone-patellar tendon-bone autograft may offer some advantages over the other options with quicker incorporation and therefore possible quicker return to play.

Correct Answer: Bone-patellar tendon-bone autograft

3165. (4012) Q7-8264:

A 40-year-old bricklayer tears his anterior cruciate ligament (ACL) after a fall from a ladder. Which of the following ACL graft options should be avoided in this patient:

1) Bone-patellar tendon-bone autograft
3) Four-strand hamstring tendon allograft
2) Quadriceps tendon allograft
5) Achilles tendon allograft
4) Four-strand hamstring tendon autograft

This patient is a good candidate for an allograft based on his age and activity level. Also, the bone-patellar tendon-bone should be avoided due to all of the kneeling in his occupation and possible anterior knee pain.

Correct Answer: Bone-patellar tendon-bone autograft

3166. (385) Q8-517:

What is the most common complication of interlocked cephalomedullary nail fixation of unstable intertrochanteric fractures when the piriformis fossa is intact, but the lesser trochanter is detached from the proximal fragment:

1) Non-union
3) Varus malreduction
2) Distraction of the fracture
5) Implant failure
4) Osteonecrosis of the femoral head

Subtrochanteric fractures account for approximately 15% of all proximal femur fractures. Some of the highest biomechanical stresses in the body occur in the subtrochanteric area (1200N).

Forty-five Russell-Taylor type IB subtrochanteric fractures were stabilized with interlocked cephalomedullary nails. Sixty-one percent of fractures were reduced in at least 5Â° of varus based on comparison of neck-shaft angles of the involved compared to the uninvolved side. All fractures went to union with no implant failure or report of osteonecrosis.

Nail insertion is technically demanding, requiring accurate nail length, extremity rotation, entry portal position, and proximal screw placement for good results. The posteromedial cortical buttress can be reconstructed to minimize the risk of varus displacement.Correct Answer: Varus malreduction

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3167. (388) Q8-520:

During fixation of a periarticular fracture, a key fragment of bone falls to the operating room floor. If this piece of bone is to be placed back in the wound, the most appropriate method of sterilization is:

1) Saline rinse
3) Povidone-iodine scrub/thimerosal immersion
2) Povidone-iodine scrub/saline rinse
5) Povidone-iodine scrub/povidone-iodine immersion
4) Chlorhexidine gluconate scrub/antibiotic solution immersion

Contaminated fragments of bone may need to be replaced in the wound for a number of reasons. To evaluate the best method of sterilization, contaminated bovine metatarsal segments were treated with one of the following:

- Saline rinse
- Povidone-iodine scrub with saline rinse
- Povidone-iodine scrub/autoclaving
- Povidone-iodine scrub/thimerosal immersion
- Povidone-iodine scrub/povidone-iodine immersion
- Chlorhexidine scrub/antibiotic immersion

The specimens were then cultured. Only chlorhexidine scrub/antibiotic immersion and povidone-iodine scrub/autoclaving were 100% effective in eliminating bacterial growth.Correct Answer: Chlorhexidine gluconate scrub/antibiotic solution immersion

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3168. (391) Q8-524:

When placing a transfixion wire in the proximal tibia from lateral to medial, the wire should be kept at least how far from the subchondral margin to remain extra-articular:

1) 5 mm
3) 20 mm
2) 14 mm
5) 30 mm
4) 25 mm

During proximal tibia transfixion pin placement, wires and pins should be kept outside of the boundary of the knee joint capsule to minimize the risk of developing an intra-articular infection. In a recent study, 35 cadavers were dissected to determine the location of capsular attachment to the proximal tibia. Arthroscopic measurements, as well as magnetic resonance imaging measurements, were compared to these findings. Four zones of attachment were defined:

- Zone 1 (anterior) the capsule inserts 6 mm below the joint.
- Zone 2 (posteromedial) the capsule inserts 12 mm below the joint.
- Zone 3 (posterior) the capsule inserts 30 mm below the joint.
- Zone 4 (posterolateral) the capsule inserted on average 12 mm from the joint

Transfixing wires and half pins can be safely placed in the proximal tibia without capsular penetration if they are kept more than 14 mm from the subchondral line.Correct Answer: 14 mm

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3169. (392) Q8-525:

The most significant predictor of fixation failure following internal fixation for displaced subcapital hip fractures is:

1) Initial displacement of fracture fragments
3) Preoperative comorbidity
2) Community ambulator
5) Varus reduction
4) Previous fixation failure on the contralateral side

Approximately 90% of hip fractures in the elderly occur from a simple fall. A total of 108 patients with displaced subcapital hip fractures treated with internal fixation were evaluated. When comparing preoperative radiograph information, clinical information, and postoperative radiograph information, the most important predictors of failure of fixation included varus reduction and perceived difficulty by the surgeon on achieving a reduction.

If a patient had a varus reduction or the surgeon had difficulty achieving a satisfactory reduction, fixation was 4.3 times more likely to fail. If both components existed together, fixation was 13.6 times more likely to fail.Correct Answer: Varus reduction

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3170. (394) Q8-527:

Which of the following parameters of intramedullary reamers results in increased intramedullary pressure values:

1) Sharp reamer
3) Small shaft diameter relative to the reamer head
2) Shallow flutes
5) Slow advancement of the reamer
4) Multiple passes with each reamer

Intramedullary pressure values for 5 commercially available reaming systems were measured using 9.5-mm and 13-mm reamers at a constant speed. The system with the thinnest shaft was found to produce the lowest pressure values and vice versa. To avoid excessive pressures in the medullary canal, reamers should be kept sharp, have deep flutes, and have small shafts relative to the diameter of the reamer head. In addition, the reamer should be advanced slowly and multiple passes should be made with each reamer.Correct Answer: Shallow flutes

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3171. (396) Q8-529:

Which of the following factors is not a predictor of 1-year mortality following hip fracture in the elderly population:

1) American Society of Anesthesiologists rating of operative risk 3 or 4
3) Pre-injury dependency in basic activities of daily living
2) Development of 1 or more in-hospital postoperative complications
5) Patients older than 65 years of age
4) History of malignancy other than skin cancer

Aharonoff and Koval identified and prospectively evaluated 612 patients who were older than 65 years of age, previously ambulatory and home dwelling, and had femoral neck or intertrochanteric hip fractures of a nonpathologic origin. All patients received operative treatment and followed a similar postoperative protocol.

In multivariate analyses, the factors predictive of increased 1-year mortality were:

- Patients older than 85 years of age
- Pre-injury dependency in basic activities of daily living
- A history of malignancy other than skin cancer
- American Society of Anesthesiologists rating of 3 or 4
- Development of 1 or more postoperative complications

Preoperative comorbidities and prefracture living circumstances were not shown to be significantCorrect Answer: Patients older than 65 years of age

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3172. (398) Q8-531:

During a posterolateral approach to the elbow for fixation of a proximal radius fracture, the posterior interosseous nerve (PIN) is safest with the patientâs elbow and forearm in what positions:

1) Extension and supination
3) Extension and neutral
2) Extension and pronation
5) Flexion and pronation
4) Flexion and supination

The posterolateral approach between the anconeus and extensor carpi ulnaris is frequently used during open reduction and internal fixation of proximal radius fractures.

This approach was performed in 32 cadaveric specimens to evaluate the position of the posterior interosseous nerve (PIN). The distance from the capitellum to the point where the PIN crossed the radial shaft was measured with the forearms in pronation and supination. Pronation allowed for safe exposure of the proximal 38 mm of the lateral aspect of the radius (average 52 mm). Supination decreases this proximal safe zone to as little as 22 mm (average 33.4 mm).

The distance from the radiocapitellar joint to the origin of the PIN was found to average 1.2 mm, with 98% of nerves remaining completely within the supinator muscle.Correct Answer: Flexion and pronation

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3173. (401) Q8-534:

Criteria for nonoperative management of an acetabular fracture includes all of the following except:

1) Roof arc measurement of greater than or equal to 45Â°
3) Stability demonstrated by dynamic stress radiographs
2) Unbroken computerized tomography arc at 10 mm from subchondral bone
5) Congruence of the femoral head with the unaffected acetabular roof on the anteroposterior and Judet views
4) Femoral head subluxation of 3 mm

The outcome of nonoperative treatment of acetabular fractures depends on the stability of the hip, the concentricity of the head of the femur under the roof of the acetabulum, and the condition of the roof itself. Nonoperative criteria include roof arc measurement of at least 45Â°, unbroken subchondral computerized tomography arc of 10 mm, stability of the joint on stress radiographs, and congruence off the femoral head with the unaffected acetabular roof on all three views, anteroposterior and both Judet radiographs. Any subluxation reduces the likelihood of a good result.Correct Answer: Femoral head subluxation of 3 mm

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3174. (403) Q8-536:

A patient presents to the emergency department with a segmental tibia fracture as a result of a gunshot injury with a 1-cm entrance wound. After appropriate irrigation and debridement, the wound measures 4 cm, there is no arterial injury, and the wound edges are easily approximated. Based on the Gustillo-Anderson classification, this wound is graded as:

1) Type I
3) Type IIIA
2) Type II
5) Type IIIC
4) Type IIIB

Open fractures must be graded after the first debridement. Preoperative classification of open fractures often underestimates the degree of bone and soft tissue compromise. The Gustillo-Anderson classification divides open fractures into 5 groups:

- Type I fractures have an open wound less than 1 cm in length.
- Type II wounds measure greater than 1 cm but less than 10 cm without contamination, and the wounds can be closed without flap coverage.
- Type IIIA fractures have an open wound greater than 10 cm that can be closed with delayed primary techniques. Segmental fractures and gunshot injuries are also graded IIIA.
- Type IIIB fractures require rotational of free flap wound coverage.
- Type IIIC fractures are any open fractures with an associated vascular injury that requires repair.

Correct Answer: Type IIIA

3175. (405) Q8-538:

A 10-year-old boy sustains an extension-type posterolaterally displaced supracondylar humerus fracture. The nerve most commonly injured in this fracture pattern without a compartment syndrome is:

1) Musculocutaneous nerve
3) Ulnar nerve
2) Anterior interosseous branch of the median nerve
5) Posterior interosseous branch of the radial nerve
4) Superficial radial nerve

Supracondylar humeral fractures are the most common fracture about the elbow in children. Extension-type fractures account for 98% of humerus fractures. Complications include:

- Cubitus varus
- Vascular injury
- Compartment syndrome
- Nerve palsy

Injury to the anterior interosseous branch of the median nerve is most commonly associated with posterolateral displacement. Radial nerve injury is most commonly seen with posteromedial displacement.

Most nerve injuries recover spontaneously over 6 to 8 weeks after treatment and do not need to be acutely explored.Correct Answer: Anterior interosseous branch of the median nerve

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3176. (407) Q8-540:

A 33-year-old patient presents to the emergency department with a low-velocity gunshot wound through the knee. There is no significant soft tissue injury and no fracture noted by radiograph. Treatment should include:

1) Observation
3) Local wound debridement
2) Admission for intravenous (IV) antibiotics
5) Arthroscopic irrigation and debridement, and admission for IV antibiotics
4) Local wound debridement and IV antibiotics

Gunshot wounds are becoming increasingly more common. Thirty-three patients with low-velocity gunshot wounds through the knee, no significant soft tissue injury, and no fracture necessitating repair were reviewed. All patients were treated with arthroscopic irrigation and debridement.

Five chondral injuries and 14 meniscal injuries were found that were not seen on preoperative radiographs. Seventy-one percent of patients who had no radiographic evidence of debris, loose bodies, or bullet or bone fragments were found to have debris and meniscal damage.

Patients who sustain low-velocity gunshot wounds through the knee have soft tissue injuries not visible on plain radiographs in most cases. Operative management of these injuries is warranted.Correct Answer: Arthroscopic irrigation and debridement, and admission for IV antibiotics

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3177. (408) Q8-541:

A patient presents with a complete ulnar collateral ligament rupture of the thumb. The structure responsible for a Stener lesion in this injury is the:

1) Extensor pollicis aponeurosis
3) Volar plate
2) Abductor pollicis brevis aponeurosis
5) Flexor pollicis longus aponeurosis
4) Adductor pollicis aponeurosis

In 1962, Stener described a unique anatomic derangement in 25 of 39 cases of complete rupture of the ulnar collateral ligament of the thumb. At the time of operation, he found the adductor pollicis aponeurosis interposed between the distally avulsed ligament and its insertion onto the base of the proximal phalanx. He concluded that without contact at the site of the rupture, ligament healing would be imperfect and result in a lax ulnar capsule regardless of the period of immobilization.Correct Answer: Adductor pollicis aponeurosis

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3178. (409) Q8-542:

The main deforming force in a Bennett fracture-dislocation of the thumb is due to the pull of:

1) Abductor pollicis longus
3) Extensor pollicis longus
2) Abductor pollicis brevis
5) Flexor pollicis brevis
4) Extensor pollicis brevis

The mechanism of injury in a Bennett fracture-dislocation is an axial blow directed against the partially flexed first metacarpal. The fracture line characteristically separates the major part of the metacarpal from a small volar lip fragment. The volar lip fragment is anchored by the anterior oblique ligament and the remainder of the metacarpal is pulled dorsally and radially by the abductor pollicis longus. The distal attachment of the adductor pollicis levers the base further dorsally.Correct Answer: Abductor pollicis longus

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3179. (410) Q8-543:

The optimal level for a below knee amputation is:

1) 15 cm below the tibial tubercle
3) At the level of the tibial tubercle
2) 10 cm below the patella
5) 5 cm below the patella
4) 5 cm below the tibial tubercle

The preferred method is tibial transection at 12 cm to 15 cm distal to the tibial tubercle with a posterior myocutaneous flap. The metabolic cost of walking, as well as functional outcomes, are directly related to the length of the residual limb (with an adequate soft tissue envelope) and the number of usable joints preserved. The ability to use the posterior compartment muscles for coverage determines length of the stirrup.Correct Answer: 15 cm below the tibial tubercle

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3180. (411) Q8-544:

A patient with a traumatic brain injury will heal a closed tibial diaphyseal fracture:

1) Slower than a normal patient
3) No differently than a normal patient
2) Faster than a normal patient
5) With less abundant callus formation than a normal patient
4) With more abundant callus formation than a normal patient

It has generally been believed that fractures heal faster and with âexuberant callusâ in traumatic brain injured patients. However, the results in large studies of both tibial and femoral fractures have contradicted this notion. Garland reviewed 47 tibial fractures in head trauma patients and failed to demonstrate either an early rate of union or an abnormally high union rate. Furthermore, exuberant callus was not observed roentgenographically. Tibia fractures in adults with head injuries appeared to heal in a fashion similar to fractures in normal patients.Correct Answer: No differently than a normal patient

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3181. (412) Q8-545:

Contraindications to retrograde nailing of a femur fracture include which one of the following:

1) Skeletal immaturity
3) Morbid obesity
2) Pregnancy
5) Ipsilateral hip fracture
4) Ipsilateral tibia fracture

The recent clinical and experimental literature supports the use of retrograde femoral nailing. Revised techniques and newer implants appear to have minimized the risk of major complications while maintaining the perceived advantages of retrograde nailing.

Most investigators have defined specific indications and contraindications for retrograde nailing. Contraindications include skeletal immaturity and a history of knee joint sepsis. Indications include:

- Multisystem injury
- Trauma involving multiple extremity fractures
- Ipsilateral vascular injury
- Fracture in the morbidly obese
- Isolated fracture above a preexisting total knee prosthesis or below a hip prosthesis
- Ipsilateral hip/acetabular fracture
- Spine injury or uncleared spine

A relative indication is pregnancy as it reduces the amount of radiation directly to the abdomen.Correct Answer: Skeletal immaturity

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3182. (413) Q8-546:

A patient with a closed, spiral diaphyseal humerus fracture is noted to have a radial nerve palsy. After the fracture is reduced and splinted in the emergency department, the radial nerve palsy persists. Treatment should be:

1) Remanipulation and cast application
3) Observation and surgical exploration if function does not return within 1 year
2) Immediate surgical exploration of the radial nerve
5) Immediate electromyogram followed by surgical exploration within 1 week of fracture
4) Observation and surgical exploration if function does not return within 3 to 4 months

Up to 18% of humeral shaft fractures have an associated radial nerve injury. Although the Holstein-Lewis fracture (oblique, distal one-third) is best known for its association with neurologic injury, radial nerve palsy is most commonly associated with middle third humeral fractures. Most nerve injuries are a neuropraxia or axonotmesis and 90% will resolve within 3 to 4 months. An electromyogram after 4 weeks is helpful in many cases.Correct Answer: Observation and surgical exploration if function does not return within 3 to 4 months

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3183. (414) Q8-549:

A pure radiocarpal dislocation associated with a radial styloid fracture indicates injury through which of the following:

1) Scapholunate joint
3) Lesser arc
2) Greater arc
5) Space of Poirier
4) Inferior arc

The typical fall on an outstretched hand results in wrist dorsiflexion, ulnar deviation, and intercarpal supination. These forces enter the radiocarpal unit from the lateral or radial side then progress toward the ulnar, thus demonstrating a âtransverseâ instability pattern. The pathologic forces typically follow 1 of 3 paths known as the greater, lesser, and inferior arcs. The paths of the greater and lesser arc injuries are similar because in both injuries the lunate remains reduced in the lunate fossa of the radius. The distinction between the 2 injuries lies in the fact that the injury complex involves fracture through the scaphoid (greater arc) or rupture of the intercarpal ligaments (lesser arc).

Inferior arc injury occurs when the forces are transmitted from radial to ulnar at the radiocarpal level. Often, this injury is accompanied by fractures of the radial and ulnar styloids. The most severe injury in the inferior arc spectrum is radiocarpal dislocation.Correct Answer: Inferior arc

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3184. (415) Q8-550:

Six weeks after open reduction and internal fixation of a talar neck fracture, an anteroposterior radiograph of the ankle reveals a lucency deep to the subchondral surface of the talar dome. This indicates:

1) Malreduction of the fracture
3) Collapse of the dome of the talus
2) Osteonecrosis of the talus
5) Revascularization of the talus
4) Associated tibial plafond impaction

The talus is composed of 7 articular surfaces covering 60% of the bony surface. Vascular access to the bone is limited to the nonarticular areas. An anastomotic sling of vessels provides the blood supply to the body of the talus that include: laterally, the artery of the tarsal sinus; medially, the artery of the tarsal canal, and additional arteries that enter dorsally through the neck and on the medial surface of the body.

The likelihood of talar body osteonecrosis increases with the severity of the injury. The diagnosis of osteonecrosis is routinely made radiographically by the absence of a Hawkin sign. This lucency deep to the subchondral surface of the dome of the talar dome on an anteroposterior radiograph of the ankle obtained 6 to 8 weeks after injury is an indication of revascularization.Correct Answer: Revascularization of the talus

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3185. (416) Q8-551:

The risk of developing avascular necrosis of the femoral head after a Pipkin type II hip fracture-dislocation is:

1) Equal to a simple dislocation
3) Lower than a simple dislocation
2) Higher than a simple dislocation
5) Equal to a patient with an associated femoral neck fracture
4) Equal to a patient with an acetabulum fracture without a femoral head fracture

Approximately 7% of posterior dislocations of the hip have associated fractures of the femoral head or neck. Pipkin categorized these into 4 types:

- Type I â Fracture of the femoral head caudad to the fovea
- Type II â Fracture of the femoral head cephalad to the fovea
- Type III â Type I or II associated with a femoral neck fracture
- Type IV â Type I, II, or III associated with a fracture of the acetabulum

Patients with these types of fracture-dislocations are at a high risk for developing osteonecrosis and post-traumatic degenerative arthritis. The prognosis for these injuries varies. Pipkin types I and II have the same prognosis as a simple dislocation. Pipkin type IV injuries roughly have the same prognosis as acetabular fractures without femoral head fracture. Pipkin type III injuries have a poor prognosis with a 50% rate of post-traumatic osteonecrosis.Correct Answer: Equal to a simple dislocation

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3186. (417) Q8-553:

A 35-year-old construction worker who presents after a fall is found to have a fracture involving 65% of the coronoid process and an anatomically reduced elbow joint. Treatment should include:

1) Immediate range of motion
3) Long arm cast immobilization
2) Excision of the fragment
5) Static external fixation
4) Open reduction and internal fixation

Fractures of the coronoid process of the ulna are commonly seen in approximately 10% of elbow dislocations. Regan and Morrey divided these injuries into 3 types:

- Type 1 â Avulsion of the tip of the coronoid process
- Type 2 â A fracture less than 50% of the coronoid process
- Type 3 â A fracture more than 50% of the coronoid process

Closed treatment and early range of motion is recommended for types 1 and 2 fractures because these fractures do not result in anteroposterior elbow instability. However, type 3 fractures have a poor outcome with immobilization. Reduction and fixation is important because the base of the coronoid also provides attachment for the insertion of the medial collateral ligament and part of the anterior capsule, as well as providing a physical block to posterior subluxation of the proximal ulna.Correct Answer: Open reduction and internal fixation

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3187. (418) Q8-554:

Malunion resulting in loss of radial bow after open reduction and internal fixation of a diaphyseal radius and ulna fracture will most often result in:

1) Loss of elbow motion
3) Early wrist arthritis
2) Loss of grip strength
5) No significant loss of function
4) Early elbow arthritis

Diaphyseal fractures of the radius and ulna present specific problems not encountered with fractures of the shafts of other long bones. The recovery of function after fracture of the forearm depends on the return of rotation of the forearm, the maintenance of a functional range of motion of the elbow and wrist, and recovery of grip strength. Malreduction and malalignment can result in poor function, particularly with loss of forearm rotation and grip strength.

Schemitsch and Richards evaluated 55 patients with both bone forearm fractures treated with plating at an average of 6 years after injury. Ninety-eight percent of the fractures had healed. A good functional result (more than 80% of normal rotation of the forearm) was associated with restoration of the normal amount and location of the radial. Similarly, the recovery of grip strength was associated with restoration of the location of the radial bow toward normal.Correct Answer: Loss of grip strength

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3188. (419) Q8-556:

Injury Severity Score (ISS) is defined as:

1) The square of the Glascow Coma Scale
3) The sum of the squares of AIS grades for all body regions
2) The sum of the highest Abbreviated Injury Scale (AIS) grades in the 3 most severely injured body regions
5) The sum of the squares of the highest AIS grades in the 3 most severely injured body regions
4) The sum of the squares of the AIS grades for spine, upper extremity and lower extremity

The Injury Severity Score (ISS) was designed to summarize the severity of multiple injuries. The ISS is the sum of the squares of the highest Abbreviated Injury Scale (AIS) grades in the 3 most severely injured body regions. The 6 body regions of injuries used in ISS are head/neck, face, chest, abdominal or pelvic contents, extremities or pelvic girdle, and external.

The score ranges from 1 to 75. A patient with an AIS of 6 in any region is assigned an ISS of 75. Generally, multiple trauma patients are defined as patients with an ISS greater than or equal to 18. An ISS less than 30 is usually indicative of a good prognosis, unless associated with a severe head injury. An ISS more than 60 is usually fatal. The accuracy of severity scoring decreases in the geriatric population.Correct Answer: The sum of the squares of the highest AIS grades in the 3 most severely injured body regions

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3189. (420) Q8-557:

When treating a tibial shaft fracture with a unilateral external fixator, all of the following increase the stiffness of the construct except:

1) Increasing pin diameter
3) Increasing pin number
2) Wide pin spread within a segment
5) Double-stacking connecting bars
4) Increasing distance between the connecting bar and the bone

The stiffness of external fixator constructs has been widely studied and depends on multiple factors. Each variable has an incremental contribution to overall stiffness. For a unilateral frame, the key features that determine the performance of the frame are:

- Pin diameter
- Pin number
- Pin spread
- Number of connecting bars
- Distance from the connecting bars to the loading axis

When pin diameters are too small, local stresses can lead to micromotion and ultimate pin failure. Multiple pins with a wide pin spread in each fracture segment will substantially increase stiffness. Double-stacking connecting bars as well as a decrease in the distance from the connecting bar to the bone have also been shown to have significant effects on construct stiffnessCorrect Answer: Increasing distance between the connecting bar and the bone

3190. (421) Q8-558:

A diminished risk for cutout failure of a screw in the femoral head can be predicted by a tip-apex distance less than 25 mm. This distance is determined by:

1) The distance from the tip of the greater trochanter to the apex of the femoral head
3) The distance from the tip of the implant to the apex of the femoral head on the lateral radiograph
2) The distance from the tip of the implant to the apex of the femoral head on the anteroposterior radiograph
5) The sum of the distances from the tip of the implant to the apex of the femoral head on both the anteroposterior and lateral radiographs
4) The distance from the tip of the trochanter to the apex of the implant

The location of a screw in the femoral head historically has been believed to be an important variable in the strength of the bone-implant construct. A simple way to define screw position, the tip-apex distance has been shown to be a strong predictor of failure by cutout. The distance from the tip of the implant to the apex of the femoral head is determined on the anteroposterior view and added to the value of a similar measurement obtained from the lateral view to generate the tip-apex distance. The risk of failure approaches 0 with values less than 25 mm but increases rapidly as the screw becomes more peripheral or shallowly placed. Intraoperative estimation of screw position using this technique has been shown to reduce cutout failures.Correct Answer: The sum of the distances from the tip of the implant to the apex of the femoral head on both the anteroposterior and lateral radiographs

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3191. (422) Q8-560:

Displaced scapular body fractures are most often associated with injury to:

1) Ipsilateral lung
3) Myocardium
2) Contralateral humerus
5) Cervical spine
4) Trachea

Fractures of the scapula are relatively uncommon injuries, representing 3% to 5% of shoulder fractures. The scapula is a relatively mobile structure and is well protected by a significant muscle mass.

Thompson reviewed 56 patients with 58 scapular fractures secondary to blunt trauma. The patients averaged 3.9 major injuries excluding their scapular fractures. The injury pattern associated with blunt scapular fracture is unique. Patients with scapular fracture have a high incidence of injury to the ipsilateral lung and chest wall and to the ipsilateral shoulder girdle and its contained structures. Scapular fractures provide the trauma surgeon with a reliable clinical clue that the patient is at inordinate risk to have associated injuries of major consequence to the ipsilateral lung and chest wall; the ipsilateral shoulder girdle; and the ipsilateral subclavian, axillary or brachial artery, and brachial plexus.Correct Answer: Ipsilateral lung

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3192. (423) Q8-561:

A Tillaux fracture of the distal tibia is the result of what mechanism of injury:

1) Supination
3) Dorsiflexion
2) Pronation
5) Internal rotation
4) External rotation

Tillaux originally described a special fracture occurring in older adolescents. The mechanism of injury is an external rotational force with stress placed on the anterior tibiofibular ligament, causing avulsion of the distal tibial physis anterolaterally. This occurs after the medial part of the physis has closed but before the lateral part closes. The resultant fracture through the physis runs across the epiphysis and distally into the joint, creating a Salter-Harris type III or IV fracture. Open reduction and internal fixation are indicated if the fracture is displaced. If left untreated, nonunions may result.Correct Answer: External rotation

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3193. (424) Q8-562:

Inability to achieve a closed reduction of a lateral subtalar joint dislocation is most commonly due to interposition of what structure:

1) Tibialis anterior tendon
3) Deltoid ligament
2) Tibialis posterior tendon
5) Extensor digitorum brevis
4) Extensor retinaculum

Dislocations of the subtalar complex involve disruption of both the talocalcaneal and talonavicular articulations. The clinical deformity is usually apparent, but an anteroposterior view of the foot is helpful to show the position of the talonavicular joint and evidence of impaction before attempted reduction. In closed dislocations, timely reduction is important to minimize vascular compromise to the overlying soft tissues. Patient sedation, knee flexion, and firm longitudinal traction are required for successful closed reduction.

With lateral subtalar dislocations, the most common obstruction to closed reduction is the interposed posterior tibial tendon. In medial subtalar dislocations, the head of the talus may become trapped by the capsule of the talonavicular joint, the transverse fibers of the cruciate-crural ligament, or the extensor digitorum brevis muscle.Correct Answer: Tibialis posterior tendon

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3194. (425) Q8-563:

A 27-year-old sustains a closed long finger proximal interphalangeal (PIP) joint fracture-dislocation. The fracture is intra-articular and involves 30% of the dorsal articular surface of the middle phalanx. Treatment should consist of:

1) Open reduction and internal fixation
3) Closed reduction and casting
2) Closed reduction and percutaneous pinning
5) Static external fixation
4) Primary arthrodesis

Dorsal dislocations can be classified into 3 types:

- Type I (hyperextension) dislocations are characterized by avulsion of the volar plate from the middle phalanx and a minor longitudinal split in the collateral ligaments. The articular surfaces remain intact.
- Type II (dorsal dislocation) results in an avulsion of the volar plate accompanied by a major bilateral split in the collateral ligament system. There is no contact between the articular surfaces.
- Type III (fracture-dislocation) is divided into stable and unstable.

In the stable pattern, there is a fracture through the base of the middle phalanx involving less than 60% of the articular arc. The dorsal portion of the collateral ligaments remain intact to the middle phalanx which renders these injuries inherently stable and able to be treated nonoperatively.

Unstable fracture-dislocations involve more than 60% of the articular surface. Because the majority of the collateral ligament-volar plate complex inserts on the volar 40% of the articular surface, this results in instability that necessitates operative treatment.Correct Answer: Closed reduction and casting

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3195. (426) Q8-564:

An acute anterior sternoclavicular joint dislocation is closed-reduced in the emergency department, however, as the arm is brought back to the patientâs side, the joint redislocates. Treatment should consist of:

1) Repeat attempts until a stable reduction is achieved
3) Open reduction and internal fixation
2) Closed reduction and percutaneous pinning
5) Medial clavicle excision
4) Immobilization with a sling for 6 weeks

The sternoclavicular (SC) joint is injured infrequently due to its medial location. However, indirect forces transmitted from the shoulder can result in sprains, fractures, and dislocations. The vast majority of SC joint dislocations occur anteriorly, and most occur as the result of motor vehicle accidents or athletic injuries.

Open reduction or percutaneous pinning is rarely indicated for anterior dislocations and most techniques have been associated with an unacceptably high incidence of redisplacement and complication. Closed reductions are often unsuccessful with immediate redisplacement of the medial clavicle. If the medial clavicle remains unstable and redislocates, a sling is recommended for definitive treatment to support the arm until symptoms resolve. Most patients with chronic SC joint dislocations remain asymptomatic with little functional limitationCorrect Answer: Immobilization with a sling for 6 weeks

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3196. (427) Q8-565:

At the time of open reduction and internal fixation of a depressed medial tibial plateau fracture, a peripheral medial meniscus tear is identified. Treatment should consist of:

1) Total menisectomy
3) Delayed arthroscopic debridement of the meniscus after fracture union
2) Immediate repair of the meniscus
5) Meniscal replacement
4) Partial menisectomy

Tibial plateau fractures encompass a broad spectrum of both osseous and soft tissue injury. Anatomic restoration and maintenance of both joint alignment and surface congruity has been shown to yield the best results. Approximately 50% of plateau fractures have been found to have meniscal injuries. Most of the tears occur in the vascular region of the posterior half making them amenable to repair, and the tears always occur on the side with the fractured condyle. The significance of preserving the meniscus cannot be overstated. Higher rates of post-traumatic arthritis after only 70 months were reported by Lachiewicz in those patients who underwent menisectomy at the time of their open reduction compared to those with preserved menisci.Correct Answer: Immediate repair of the meniscus

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3197. (428) Q8-566:

Which of the following glenohumeral dislocations is associated with the highest incidence of vascular compromise?

1) Anterior
3) Inferior
2) Posterior
5) Anterosuperior
4) Superior

Inferior glenohumeral dislocations, or luxatio erecta, may be produced by a hyperabduction force that causes impingement of the neck of the humerus against the acromion process which levers the head out inferiorly. Severe soft tissue injury or fractures about the proximal humerus occur with this dislocation.

Mallon et al reviewed 80 cases of luxatio erecta and also discussed 6 additional cases that they treated. The literature shows that either a fracture of the greater tuberosity or a rotator cuff tear was associated with this injury in 80% of patients; 60% of the patients reviewed sustained some degree of neurologic compromise, most commonly to the axillary nerve. These injuries usually resolved and the time for recovery varied from 2 weeks to 1 year. Only 3.3% of the cases demonstrated significant vascular compromise, but this is the highest incidence for any shoulder dislocation. Doppler studies of the affected arm or observation of the patient overnight are recommended because of the potentially disastrous complications of vascular insufficiency. If there is any indication of a vascular problem, immediate arteriogram is indicated.Correct Answer: Inferior

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3198. (429) Q8-567:

The length of hospital stay for an elderly patient with isolated pubic rami fractures sustained after a fall is dependent upon which of the following pre-injury criteria:

1) Requirement of a cane or walker for ambulation
3) Nursing home residency
2) Dependence in activities of daily living
5) History of falls
4) Coronary artery disease

Pelvic fractures resulting from low-energy mechanisms are usually fractures of the individual bones of the pelvic ring that do not damage the true integrity of the ring structure. This class includes domestic falls frequently seen in the elderly population, and avulsion injuries seen in young patients.

Koval et al reviewed a series of elderly patients with pubic rami fractures. Sixty out of 63 patients (95%) required hospitalization for pain control and progressive mobilization. The hospital length of stay for the 60 admitted patients averaged 14 days; patients who had 3 or more associated medical comorbidities or required use of a cane or walker for ambulation prior to fracture were more likely to have been hospitalized >2 weeks.Correct Answer: Requirement of a cane or walker for ambulation

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3199. (430) Q8-568:

Which of the following criteria is not included in the Mangled Extremity Severity Score (MESS)?

1) Skeletal/soft tissue injury
3) Fracture pattern
2) Limb ischemia
5) Age
4) Shock

Timely amputation is indicated for a severely injured limb that, after reconstruction, would be less functional than a prosthesis. The Mangled Extremity Severity Score (MESS) has been used to predict necessity of amputation after lower-extremity trauma. Points are assigned for skeletal/soft tissue injury (1-4), ischemia time (1-6), age of the patient (0-2), and shock defined by hypotension (0-2).

In both prospective and retrospective studies, a MESS score equal or greater than or equal to 7 has had a 100% predictable value for amputation. This relatively simple, readily available scoring system of objective criteria was highly accurate in several studies in acutely discriminating between limbs that were salvageable and those that were unsalvageable and better managed by primary amputation. However, further work has demonstrated low specificity and sensitivity for amputation in multicenter trials. For this reason, any of the scoring systems should be used only as a guideline.Correct Answer: Fracture pattern

---

3200. (431) Q8-569:

A 25-year-old nonsmoking laborer presents with a closed, highly comminuted, displaced tibial plafond fracture and no other injuries. This is best managed with:

1) Immediate open reduction and internal fixation with lag screws
3) External fixation spanning the ankle and delayed internal fixation
2) Immediate open reduction and internal fixation with a buttress plate
5) Intramedullary nail
4) Closed reduction and casting

Pilon fractures are most commonly the result of an axial loading injury. Complications have been reported to be as high as 40% and include wound slough, infection, malunion, and post-traumatic arthritis. The safest approach is to delay definitive surgery until the soft tissue envelope is capable of tolerating an incision, demonstrated by resolution of blisters or the absence of tense, shiny skin. During the wait, the limb should be maintained in correct alignment and length, elevated, and protected. A temporary external fixator from the tibia to the hindfoot permits approximate reduction by ligamentotaxis, provides stability, and allows the use of foot pumps which can reduce swelling.Correct Answer: External fixation spanning the ankle and delayed internal fixation

---

3201. (432) Q8-570:

After sustaining a twisting injury, a lateral ankle radiograph reveals a fibular fracture line from anteroinferior to posterosuperior. This injury can be classified as:

1) Supination external rotation
3) Supination adduction
2) Pronation external rotation
5) Supination internal rotation
4) Pronation abduction

The 2 most widely used ankle fracture classification systems are the Danis-Weber system, which is based on the level of the fibular fracture, and the Lauge-Hansen system, which is based on experimentally created injury mechanisms.

Lauge-Hansen emphasized the influence that the position of the foot had on the injury pattern and correlated this position with the direction of the deforming forces. The pattern of the fibula fracture can be used to determine the type of fracture:

- Supination adduction results in a transverse fracture at or below the level of the joint
- Supination external rotation results in a spiral fracture from anteroinferior to posterosuperior
- Pronation external rotation results in a spiral fracture from posteroinferior to anterosuperior
- Pronation abduction results in a transverse fracture at or above the level of the joint

Correct Answer: Supination external rotation

3202. (433) Q8-571:

To confirm a suspected complete Achilles tendon rupture, a Thompson test should be done with the patient in what position:

1) Standing on the contralateral leg
3) Supine with feet extended over the table
2) Sitting with knees at 90Â° of flexion
5) Lateral decubitus with affected side down
4) Prone with feet extended over the table

Achilles tendon ruptures occur most commonly in healthy men in their third to fifth decade of life who were participating in recreational sports activities at the time of the injury. In acute cases, physical examination will reveal a palpable depression over the area of the tendon rupture, weakness of plantar flexion, and positive results on Thompsonâs test. Thompsonâs test is performed with the patient prone on a table with the feet extended over the end of the table. The calf muscles are then squeezed between the examinerâs thumb and forefingers in the place of widest girth. A positive test occurs when there is no plantar movement of the foot, indicating a complete rupture of the heel cord.Correct Answer: Prone with feet extended over the table

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3203. (434) Q8-572:

When comparing a nonbridging external fixator to external fixation spanning the wrist for treatment of unstable distal radius fractures, a bridging frame has been shown to:

1) Diminish finger range of motion
3) Improve wrist range of motion
2) Improve grip strength
5) Maintain carpal alignment
4) Maintain volar tilt

McQueen performed a randomized, prospective study on 60 patients with unstable fractures of the distal radius to compare bridging with nonbridging external fixation using pins placed in the distal fragment of the radius. The radiological results showed significant improvement in the nonbridging group at all stages of review. In particular, normal volar tilt and carpal alignment were regained and maintained.

The functional results at 6 weeks, 3 months, 6 months, and 1 year showed statistically better grip strength and flexion in the nonbridging group at all stages of review. Other ranges of movement showed an early advantage in the nonbridging group. Nonbridging external fixation is the treatment of choice for unstable fractures of the distal radius that have sufficient space for the placement of pins in the distal fragment.Correct Answer: Diminish finger range of motion

---

3204. (615) Q8-853:

Early fixation devices for femur fractures in skeletally immature patients included all of the following except:

1) The Lane plate
3) Compression plates
2) Beef bone plate
5) External fixation
4) Intramedullary plugs made of ivory or bone

Early fixation devices for femur fractures in skeletally immature patients included all of the following except compression plates. The advent of the compression plates took place in the 1960s, heralded by the ankle orthosis group in Europe.Correct Answer: Compression plates

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3205. (616) Q8-854:

An "immediate" hip spica cast is applied

1) On admission
3) Within the first 8 hours of injury
2) Within the first 4 hours of injury
5) Within the first 24 hours of injury
4) Within the first 12 hours of injury

An "immediate" hip spica cast is applied within the first 24 hours of injury.Correct Answer: Within the first 24 hours of injury

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3206. (617) Q8-855:

Apex posterior malalignment of a femur fracture is poorly tolerated because:

1) The bone has less remodelling capacity in the anterior / posterior plane.
3) The risk of overgrowth is greater in patients with an apex posterior malalignment than other angular malalignments.
2) Apex posterior malalignment creates hyperextension in the knee at heel strike, which creates pain with ambulation.
4) Apex posterior malalignment following a femoral shaft fracture can create a traction injury to the sciatic nerve.

Apex posterior malalignment of a femur fracture is poorly tolerated because an apex posterior malalignment creates hyperextention in the knee at heel strike which creates pain with ambulation. This can produce pain with ambulation. The pain can be so severe that it creates dysfunction in the lower extremity.Correct Answer: Apex posterior malalignment creates hyperextension in the knee at heel strike, which creates pain with ambulation.

3207. (618) Q8-856:

When do children have the greater capacity for overgrowth following a femoral shaft fracture?

1) Birth to 2 years of age
3) Six to 9 years of age
2) Two to 5 years of age
5) Between 9 years of age and closure of the distal femoral physis
4) Nine to 12 years of age

Children have the greatest capacity for overgrowth following a femoral shaft fracture between 6 and 9 years of age. Because of this, more shortening can be accepted in a femur fracture in this age range than at other times.Correct Answer: Six to 9 years of age

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3208. (619) Q8-857:

An "early" spica cast is applied:

1) Within the first 24 hours
3) In the second week after injury
2) Between the first and seventh day after admission
4) In the third week after injury

An "early" spica cast is applied between one and seven days after a child sustains a diaphyseal femur fracture. An "early" spica cast is normally applied to a younger child who is treated with split Russell's traction prior to cast application. Children older than 6 years of age are treated with 90/90 skeletal traction until a cast can be applied. These children often have to remain hospitalized in traction until the second week after injury.Correct Answer: Between the first and seventh day after admission

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3209. (620) Q8-858:

One of the most common complications following the use of an external fixation device for the treatment of diaphyseal femur fracture is:

1) Shortening
3) Malrotation
2) Angulation
4) Refracture

One of the most common complications following the use of external fixation devices for the treatment of a pediatric diaphyseal femur fracture is malrotation. The short external rotators outwardly turn the proximal femoral fragment, creating an internal rotation deformity at the fracture site. If the pins are applied parallel to one another and the floor at the time the frame is constructed, the child will have an internal rotation malalignment at union. To prevent this from occurring, the surgeon must direct the proximal pin cluster from slight posterior to slight anterior, compensating for the effects of the short external rotators on the proximal fragment.Correct Answer: Malrotation

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3210. (621) Q8-859:

The middle layer of lateral extra-articular stabilizing structures of the knee include all of the following except:

1) Fibular collateral ligament
3) Arcuate ligaments
2) Fabello-fibular ligament
4) Lateral capsule of the knee

The lateral capsule of the knee is the deep stabilizing layer eventing a varus stress of the knee.Correct Answer: Lateral capsule of the knee

---

3211. (622) Q8-863:

Figure 2A

A 45-year-old, otherwise healthy female, was admitted to the trauma service after a snowmobile accident. Examination showed that she had pain in and deformity of her left thigh, with an open wound over her posterolateral buttock. A x-ray of her femur is shown in Slide 2A. What should be done next?

1) Immediate surgery.
3) Computed tomography scan.
2) Radiographs of spine and pelvis.
4) Magnetic resonance imaging.

The next thing that should be done is a screening view of the pelvis, which in this case showed an associated anterior column acetabular fracture. Radiographs that show the femoral neck well must also be obtained in order to rule out associated femoral neck fracture.Correct Answer: Radiographs of spine and pelvis.

3212. (623) Q8-864:

Figure 2B **Figure 2C**

A 45-year-old, otherwise healthy female, was admitted to the trauma service after a snowmobile accident. Examination showed that she had pain in and deformity of her left thigh, with an open wound over her posterolateral buttock. Following evaluation by the trauma team, the patient was stable. The next step in the management of her fracture should be:

1) Immediate surgery to debride her wound, with placement of skeletal traction and delayed nailing of the femur.
3) Immediate surgery to debride the wound and nailing of the femur fracture.
2) Immedicate surgery to debride the wound and external fixation of the femur fracture.
4) Immediate surgery to debride the wound and repair of the femur fracture and acetabular fracture.

Open fractures must always be operated on immediately with aggressive irrigation and debridement. Once this is done, immediate internal fixation is appropriate. In this case, treatment included placement of tobramycin beads in the wound, with delayed closure. Her acetabular fracture was repaired by an anterior approach several days later. Anteroposterior (AP) and lateral radiographs of the femur are shown in Slides 2B and 2C.Correct Answer: Immediate surgery to debride the wound and nailing of the femur fracture.

3213. (624) Q8-865:

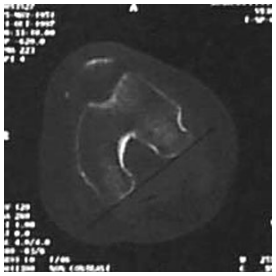

Figure 2A **Figure 2D** **Figure 2E**

A 45-year-old, otherwise healthy female, was admitted to the trauma service after a snowmobile accident. Examination showed that she had pain in and deformity of her left thigh, with an open wound over her posterolateral buttock. A x-ray of her femur is shown in Slide 2A. The patient's femur healed, but she complained of external rotation of her left foot. Her radiograph is shown in Slide 2D. The likely explanation of this is:

1) Malreduction of her acetabular fracture.
3) Heterotopic ossification.
2) Contracture of the external rotator muscles around her hip.
5) Contracture of the abductor muscles.
4) Malunion of her femoral shaft fracture.

Rotational deformity following femoral nailing should always be checked by an examination of the relative arcs of hip rotation following surgery. In this patient, a computed tomography (CT) scan of both legs was done Slide 2E, showing a 55Â° external rotation deformity of the proximal femur.Correct Answer: Malunion of her femoral shaft fracture.

3214. (625) Q8-866:

Figure 2A **Figure 2F**

A 45-year-old, otherwise healthy female, was admitted to the trauma service after a snowmobile accident. Examination showed that she had pain in and deformity of her left thigh, with an open wound over her posterolateral buttock. A x-ray of her femur is shown in Slide 2A. The incidence of rotational malunion after femoral nailing is:

1) 2%
3) 12%
2) 7%
5) 25%
4) 20%

Rotational deformity following femoral nailing occurs in about 7% of cases. Because of continued complaints of gait disturbance and discomfort, the patient underwent rotational osteotomy and repeat nailing (Slide 2F).Correct Answer: 7%

3215. (626) Q8-867:

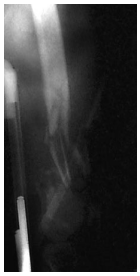

Figure 3A **Figure 3B** **Figure 3C** **Figure 3D**

A 32-year-old female with schizophrenia was found lying below a broken sixth floor window early one morning, by construction workers. She had severe open wounds above both knees and obvious fractures. She was conscious and did not have any neck or back pain. On arrival at the hospital, she was hypothermic but otherwise stable. Radiographs of her legs are shown in Slides 3A, 3B, 3C, and 3D. The patient was found to have no other injuries. The next step in her management is:

1) Observation in the Intensive Care Unit for arrhythmias.
3) Immediate debridement and stabilization
2) Application of skeletal traction and antibiotic therapy
5) Delayed internal fixation.
4) Immediate internal fixation with bone grafting.

As for all open fractures, immediate debridement and stabilization are mandatory. The need for bone grafting is much less when careful indirect reduction techniques are utilized, and when necessary, is delayed until the soft tissue wounds have stabilized.Correct Answer: Immediate debridement and stabilization

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3216. (627) Q8-868:

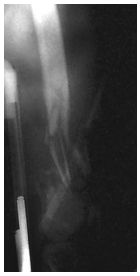

Figure 3A

Figure 3B

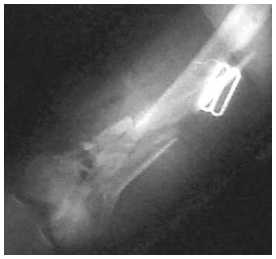

Figure 3C

Figure 3D

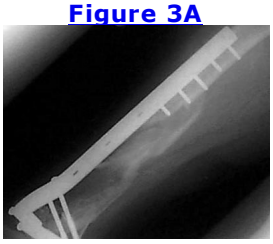

Figure 3E

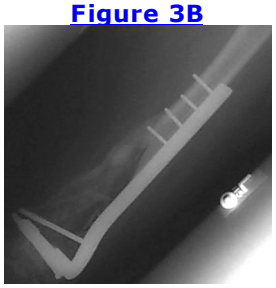

Figure 3F

A 32-year-old female with schizophrenia was found lying below a broken sixth floor window early one morning, by construction workers. She had severe open wounds above both knees and obvious fractures. She was conscious and did not have any neck or back pain. On arrival at the hospital, she was hypothermic but otherwise stable. Radiographs of her legs are shown in Slides 3A, 3B, 3C, and 3D. The patient was found to have no other injuries. What is the best option for internal fixation?

1) Cannulated lag screws.
3) Retrograde intramedullary nail.
2) Antegrade intramedullary nail.
5) Condylar buttress plate.
4) Dynamic condylar screw.

Dynamic condylar screw fixation is the best way to avoid rotational deformity. Rotational deformity following femoral nailing should always be checked by an examination of the relative arcs of hip rotation following surgery. In this patient, a computed tomography (CT) scan of both legs was done (Slide 2E), showing a 55Â° external rotation deformity of the proximal femur.Correct Answer: Dynamic condylar screw.

3217. (628) Q8-869:

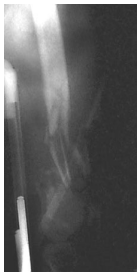

Figure 3A **Figure 3B** **Figure 3C** **Figure 3D**

A 32-year-old female with schizophrenia was found lying below a broken sixth floor window early one morning, by construction workers. She had severe open wounds above both knees and obvious fractures. She was conscious and did not have any neck or back pain. On arrival at the hospital, she was hypothermic but otherwise stable. Radiographs of her legs are shown in Slides 3A, 3B, 3C, and 3D. If the leg had valgus instability immediately after fixation, what is the likely cause?

1) Midclavicular injury.
3) Unstable fixation.
2) Occult tibial plateau fracture.
5) Infection
4) Inadequate external fixation.

In cases of severe metaphyseal comminution, varus/valgus instability is usually due to inadequate fixation. Stability should always be checked during surgery. If after lateral plate fixation, instability is present, the medial external fixator or a separate medial plate placed through a limited medial incision may be done.Correct Answer: Unstable fixation.

3218. (629) Q8-870:

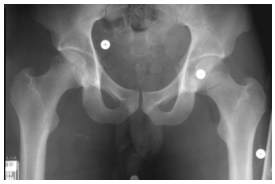

Figure 1A **Figure 1B**

A 29-year-old, otherwise healthy male, was seen in the emergency room after a motorcycle accident. Examination showed that his left leg was abnormally shortened and internally rotated. There were no neurologic or vascular deficits. An anteroposterior x-ray of his pelvis is shown in Slide 1A. An attempt at closed reduction was performed 4 hours after his injury. The post-reduction x-ray is shown in Slide 1B. This patient's risk of avascular necrosis and degenerative arthritis, respectively, are:

1) 15%, 30%
3) 50%, 75%
2) 15%, 75%
5) 25%,50%
4) 80%, 30%

Avascular necrosis results in 15%, and is usually evident within the first year (but may appear up to 3 years after injury). The risk of avascular necrosis depends on the time to reduction. Reduction after 8 hours from injury markedly increases the risk of avascular necrosis. Degenerative arthritis may be the result in up to 75% of patients at long-term follow-up.Correct Answer: 15%, 75%

3219. (630) Q8-871:

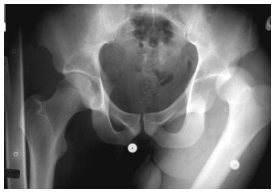

Figure 1A

A 29-year-old, otherwise healthy male, was seen in the emergency room after a motorcycle accident. Examination showed that his left leg was abnormally shortened and internally rotated. There were no neurologic or vascular deficits. An anteroposterior x-ray of his pelvis is shown in Slide 1A. Following the closed reduction, the next step in management should be:

1) Observation
3) CT
2) Bone scan
5) Chart x-ray
4) MRI

CT scans are recommended to determine if there are any osteochondral fragments within the joint, any evidence of posterior wall fracture, or any femoral head fracture. If intra-articular debris is noted, or if the reduction is not congruent, then arthrotomy and irrigation of the joint is necessary.Correct Answer: CT

3220. (631) Q8-872:

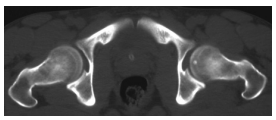

Figure 1A **Figure 1C**

A 29-year-old, otherwise healthy male, was seen in the emergency room after a motorcycle accident. Examination showed that his left leg was abnormally shortened and internally rotated. There were no neurologic or vascular deficits. An anteroposterior x-ray of his pelvis is shown in Slide 1A. This patient's CT scan is shown in Slide 1C. The patient should be managed with:

1) Activities as tolerated
3) Protected weight bearing with crutches for 1 year
2) Protected weight bearing with crutches for 6 weeks
5) Protected weight bearing with crutches for 6 months.
4) Surgery

Following uncomplicated reduction, the patient is treated with protected weight-bearing for 4 to 6 weeks. Operative intervention is necessary if congruent closed reduction cannot be obtained, if an associated posterior wall fracture greater than 25% of the wall is identified, or if osteochondral debris is present within the joint space.Correct Answer: Protected weight bearing with crutches for 6 weeks

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3221. (632) Q8-873:

A 41-year-old, otherwise healthy male, was seen in the emergency room after falling off his bicycle. Examination showed that he was unwilling to bear weight on his left leg, and had pain with any attempted movement of his hip. He preferred to keep his leg externally rotated. There were no neurologic or vascular deficits. The next step in his evaluation should be:

1) Observation and crutches for pain
3) Technetium bone scan
2) Radiographs
4) MRI

Plain anteroposterior and lateral radiographs are indicated as the primary imaging method to evaluate suspected hip trauma. Although femoral neck fractures are less common in this age group, they must be considered in anyone with groin, thigh, or knee pain. Observation alone may be considered in a patient who is able to weight-bear comfortably and tolerates passive internal and external rotation without pain. Bone scans are generally ordered to evaluate the perfusion of the femoral head in a patient known to have a fracture, and have also been recommended for the evaluation of occult femoral neck stress fractures. However, MRI has proven superior for both of these indications. Plain radiographs in two planes are required for the initial diagnosis of hip trauma, and can differentiate from dislocation, acetabular fracture, femoral neck fracture, or pelvic ring trauma, or other lesions (infectious, neoplastic).Correct Answer: Radiographs

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3222. (633) Q8-874:

Figure 2A **Figure 2B**

Anteroposterior and lateral radiographs are shown in Slides 2A and 2B. This patient should be managed with:

1) Observation and crutches for pain
3) Internal fixation
2) Skeletal traction
4) Arthroplasty

Femoral neck fractures always require internal fixation, except in the most debilitated of patients. Anatomic reduction is the prerequisite to internal fixation, and requires open reduction if closed manipulation is not successful. Once reduced, multiple (three or four) cannulated screws are now considered the method of choice for subcapital and transcervical fractures. Basilar neck fractures are usually treated with a sliding hip screw and additional derotation screw.Correct Answer: Internal fixation

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3223. (634) Q8-875:

Figure 2C **Figure 2D**

Postoperative radiographs are shown in Slides 2C and 2D. This patient risk of avascular necrosis is:

1) 5%
3) 50%
2) 20%
4) 80%

Avascular necrosis complicates approximately 20% of displaced femoral neck fractures. In patients considered to be at risk, MRI can be performed early to confirm the diagnosis. Protected weight-bearing is then recommended in order to lessen the risk of femoral head collapse.Correct Answer: 20%

3224. (635) Q8-876:

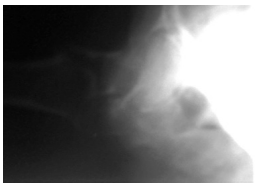

Figure 3A **Figure 3B**

An 85-year-old female was admitted after a presumed fall at her nursing home. Examination showed that the patient was demented, with pain in her right leg, which was shortened and externally rotated. Radiographs of the patients hip are shown in Slides 3A and 3B. The patients fracture is classified as:

1) Type I
3) Type III
2) Type II
4) Type IV

The anteroposterior and lateral radiographs show an unstable fracture in which the posteromedial buttress, containing the lesser trochanter, has fractured. This represents the Type III fracture of Kyle and Gustilo.Correct Answer: Type III

3225. (636) Q8-877:

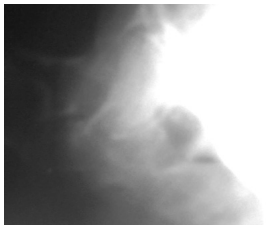

Figure 3A **Figure 3B**

An 85-year-old female was admitted after a presumed fall at her nursing home. Examination showed that the patient was demented, with pain in her right leg, which was shortened and externally rotated. Radiographs of the patients hip are shown in Slides 3A and 3B. This fracture is best managed with:

1) Multiple screws
3) Internal fixation with sliding hip screw and 6-hole side-plate
2) Internal fixation with sliding hip screw and 4-hole side-plate
4) Arthroplasty

The sliding hip screw concept has made the treatment of unstable intertrochanteric fractures predictably successful, providing that the technique is performed properly. This includes center head placement of the lag screw within 5 mm of subchondral bone. Four screws are generally sufficient to anchor the side-plate in normal bone, but 6 screws are necessary in osteoporotic individuals.Correct Answer: Internal fixation with sliding hip screw and 6-hole side-plate

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3226. (637) Q8-878:

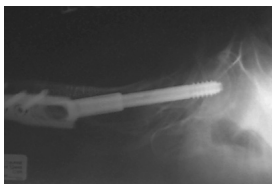

Figure 3C **Figure 3D**

Postoperative radiographs are shown in Slides 3C and 3D (note that despite the recommendation above, the surgeon chose a 4-hole side-plate for this patient). This patient's risk of avascular necrosis is:

1) <5%
3) 50%
2) 20%
4) >80%

Avascular necrosis is rarely seen after intertrochanteric fracture.Correct Answer: <5%

3227. (638) Q8-879:

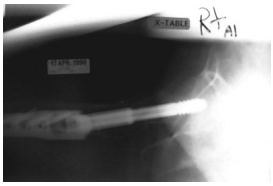

Figure 3E **Figure 3F**

Follow-up radiographs taken 4 weeks later are shown in Slides 3E and 3F. Comparison of these films with the postoperative x-rays shows the fracture has collapsed since the fixation was performed. The surgeon's assessment and plan should be:

1) Impending failure, plan to restrict weight bearing and observe
3) Impending failure, plan to perform total hip replacement
2) Impending failure, plan to revise the internal fixation
4) Successful fixation, allow weight bearing as tolerated

The so-called sliding hip screw is designed to allow impaction of the fracture along the axis of the lag screw, allowing the fracture to settle into a stable position. This concept has revolutionized the treatment of intertrochanteric fractures by reducing the complications of cut-out and hardware breakage seen previously with fixed devices.Correct Answer: Successful fixation, allow weight bearing as tolerated

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3228. (639) Q8-880:

Figure 4A **Figure 4B**

A 32-year-old, otherwise healthy male, was seen in the emergency room after a motorcycle accident. Examination showed obvious fractures of both femurs. The patient was not wearing a helmet, and had a mild closed head injury. Formal evaluation by the trauma service did not identify any other injury. There were no gross neurologic or vascular deficits. Anteroposterior x-rays of both femurs are shown in Slides 4A and 4B. The patient has bilateral subtrochanteric femur fractures. According to the Hennepin County Medical Center, Hennepin County classification, the right and left femur fractures would be classified as:

1) Both Type I
3) Right Type I, Left Type II
2) Both Type II
4) Right Type II, Left Type I

The classification system presently used at Hennepin County Medical Center is based on treatment and divides subtrochanteric fractures into two types (Slide 13). Type I, or high subtrochanteric fractures, have a fracture into the lesser trochanter. In Type II, or low subtrochanteric fractures, the lesser trochanter remains intact and a first generation interlocking nail is used. Both types of fracture may be either simple or comminuted with shaft extension. The right femur is a Type II, or low subtrochanteric fracture. By definition, Type II fractures are below the lesser trochanter, and standard intramedullary nails may be used. The left leg has a Type I, or high subtrochanteric fracture.Correct Answer: Right Type II, Left Type I

3229. (640) Q8-882:

Figure 1

Appropriate treatment of the acute injury depicted in Slide 1 is:

1) Open reduction, internal fixation
3) Closed reduction and casting
2) Traction
4) Primary midfoot arthrodesis

N/ACorrect Answer: Open reduction, internal fixation

3230. (641) Q8-884:

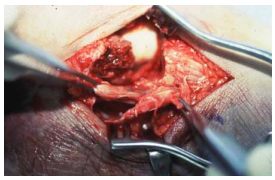

Figure 4A **Figure 4B** **Figure 4C**

Slide 4A shows the anteroposterior view of the left foot of a 52-year-old female who was involved in a high speed motor vehicle accident and suffered a closed head injury and a left foot injury. How would you treat this injury?

1) Cast treatment
3) Open reduction and internal fixation of the navicular fracture and anterior calcaneus impaction fracture
2) Open reduction and internal fixation of the navicular fracture only

Medially, open reduction and internal fixation was performed to reattach the displaced posterior tibial tendon avulsion fracture, as shown in Slide 4B. Laterally, the depressed articular surface of the calcaneus was elevated, and cancellous bone from the calcaneus was used to support the elevated fragment, thereby restoring the length of the lateral column and the congruity of the calcaneocuboid joint (Slide4C).Correct Answer: Open reduction and internal fixation of the navicular fracture and anterior calcaneus impaction fracture

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3231. (642) Q8-885:

The ankle is a complex joint with the tibia and fibula forming a mortise containing the underlying talus. The joint is stabilized by three groups of ligaments including the medial collateral, lateral collateral, and syndesmotic ligaments. Thirteen tendons, two vascular bundles, and five nerves cross the ankle joint. Biomechanically, this anatomy functions to provide a mobile, stable base for ambulation. For normal ankle function during walking, the ankle must have at least:

1) 30Â° dorsiflexion, 30Â° plantarflexion
3) 20Â° dorsiflexion, 10Â° plantarflexion
2) 10Â° dorsiflexion, 20Â° plantarflexion
5) 30Â° dorsiflexion, 0Â° plantarflexion
4) 0Â° dorsiflexion, 30Â° plantarflexion

For normal ankle function during walking, the ankle must have at least 10% dorsiflexion and 20% plantarflexion. In normal ankle walking, the reported sagittal plane rotation has generally ranged from 10 degrees to 15 degrees of dorsiflexion and from 15 degrees to 30 degrees of plantarflexion.Correct Answer: 10Â° dorsiflexion, 20Â° plantarflexion

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3232. (643) Q8-886:

In performing a lateral approach to the calcaneus for open reduction, internal fixation, the structure at risk is:

1) Lateral plantar artery
3) Dorsalis pedism artery
2) Lateral plantar nerve
5) Superficial peroneal nerve
4) Sural nerve

The sural nerve is the most likely structure to be at risk when performing a lateral approach to the calcaneus to perform an open reduction and internal fixation. Care must be taken to protect the small saphenous vein and sural nerve lying immediately posterior to the incision.Correct Answer: Sural nerve

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3233. (644) Q8-887:

Figure 2A **Figure 2B**

After reduction of the dislocated knee (Slide 2a and Slide 2b), the patient still has slightly decreased dorsalis pedis and posterior tibial pulses in her foot but has no other signs of ischemia. The next appropriate step in management of this injury is?

1) Observe vascular status of the limb and plan operative fixation of plateau fracture in the morning.
3) Obtain an arteriogram of limb.
2) Obtain a computed tomography scan to better evaluate the tibial plateau fracture.
4) Proceed to the operating room to explore the limb for a vascular injury.

In this patient, the only physical evidence of possible vascular injury is diminished pulses. Diminished pulses have been shown to be unreliable in predicting vascular injury. The next step should be to either obtain an immediate arteriogram or check ankle brachial pressures. If ankle brachial pressures are used, then the patient should have an ABI of 0.9 or greater. In addition, the patient should be closely monitored for 48 to 72 hours. If the patient has absent pulses, cold limb, or an open injury with obvious vascular injury, then the patient should be taken directly to the operating room for exploration and repair of the vessel. An arteriogram is not necessary in this situation since the location of the injury is known.Correct Answer: Obtain an arteriogram of limb.

3234. (645) Q8-888:

Figure 3A **Figure 3B**

A 30-year-old driver was involved in a motor vehicle accident. She has an isolated, closed injury shown in Slide 3a and Slide 3b. She is neurovascularly intact. What fracture type is this?

1) Schatzker I.
3) Schatzker III.
2) Schatzker II.
4) Schatzker IV.

This is a split depression injury of the lateral compartment (Type II).Correct Answer: Schatzker II.

3235. (646) Q8-889:

Figure 3A **Figure 3B**

A 30-year-old driver was involved in a motor vehicle accident. She has an isolated, closed injury shown in Slide 3a and Slide 3b. She is neurovascularly intact. What is the most appropriate management of this injury?

1) Closed treatment with a cast brace.
3) Open reduction internal fixation with bone grafting.
2) Open reduction internal fixation without bone grafting.
4) Closed reduction, percutaneous screw fixation.

The fracture is a displaced split depression (Schatzker II) fracture. The best treatment option is open reduction internal fixation using lag screws and a lateral buttress plate. The depressed fragment cannot be reduced by closed means using ligamentotaxis to facilitate the reduction. Bone grafting will hasten union.Correct Answer: Open reduction internal fixation with bone grafting.

3236. (647) Q8-890:

Figure 3A **Figure 3B**

A 30-year-old driver was involved in a motor vehicle accident. She has an isolated, closed injury shown in Slide 3a and Slide 3b. She is neurovascularly intact. What is the most appropriate postoperative plan?

1) Long leg cast for 4 weeks then aggressive physical therapy to improve range of motion and non-weightbearing for 3 months.
3) Range of motion beginning on postoperative day 2 and full weight bearing at 3 months.
2) Range of motion beginning in the recovery room and weight bearing as tolerated.
4) Long leg cast for 8 weeks and full weightbearing at 8 weeks.

After open reduction internal fixation, early range of motion is important. Range of motion should be started as soon as the soft tissues and the fracture fixation permit. Depending on the degree of comminution and the quality of the bone, partial weightbearing can be started after 6 weeks. Full weightbearing should be avoided for 3 months.Correct Answer: Range of motion beginning on postoperative day 2 and full weight bearing at 3 months.

3237. (881) Q8-1147:

Each of the following statements regarding the use of low-intensity ultrasound in fracture healing is correct except:

1) Ultrasound influences the inflammatory, reparative, and remodeling phases.
3) Ultrasound has not been shown to be beneficial in patients with comorbidities such as diabetes, vascular insufficiency, and obesity.
2) Animal studies demonstrate that ultrasound exposure results in stronger callus formation.
5) Ultrasound exposure during fracture healing accelerates the process of endochondral ossification.
4) Animal studies demonstrate that ultrasound exposure results in stiffer callus formation.

Several mechanisms have been proposed to explain the influence of low-intensity ultrasound on fracture healing. Ultrasound has been shown to stimulate angiogenesis, influencing regional blood flow to bone. In addition, chondrogenesis and chondroplasia have been shown to be positively affected by ultrasound, thus stimulating early endochondral ossification. Ultrasound is useful in patients with comorbid conditions such as smoking, obesity, and vascular insufficiency.

Correct Answer: Ultrasound has not been shown to be beneficial in patients with comorbidities such as diabetes, vascular insufficiency, and obesity.

3238. (1510) Q8-1901:

Which fascial compartment of the lower leg is most commonly affected by compartment syndrome:

1) Superficial posterior compartment
3) Lateral compartment
2) Deep posterior compartment
5) Deep anterior compartment
4) Anterior compartment

The anterior compartment of the lower leg is most commonly affected by compartment syndrome. The anterior compartment is enveloped by strong fascia and is susceptible to swelling caused by fracture and soft tissue injury.

- The anterior and deep posterior compartments have a higher incidence of compartment syndrome than the superficial posterior compartment.
- The deep posterior compartment is the most commonly missed compartment syndrome of the lower leg and is second in frequency, following anterior compartment syndromes.
- The anterior and deep posterior compartments have a higher incidence of compartment syndrome than the lateral compartment.
- The leg consists of four compartments including the anterior, lateral, superficial posterior, and deep posterior. A deep anterior compartment does not exist.

Correct Answer: Anterior compartment

3239. (1511) Q8-1902:

The diagnosis of compartment syndrome is most commonly missed in which compartment of the lower leg:

1) Superficial posterior compartment
3) Lateral compartment
2) Deep posterior compartment
5) Deep anterior compartment
4) Anterior compartment

Compartment syndrome is most commonly missed in the deep posterior compartment. Like the anterior compartment, the deep posterior compartment is enveloped in fascia and is immediately adjacent to the tibia; however, the deep posterior compartment is more difficult to clinically assess secondary to its deep location. Associated findings include pain with passive extension of the toes and plantar foot numbness.

- Compartment syndrome involving the superficial posterior compartment, lateral compartment, and anterior compartment is easy to detect because it is readily palpable on examination.
- There is no deep anterior compartment in the leg.

Correct Answer: Deep posterior compartment

3240. (1512) Q8-1903:

How many compartments exist in the foot:

1) 2
3) 9
2) 4
5) 11
4) 10

There are nine separate compartments in the foot including the calcaneal, medial, superficial, lateral, adductor, and four separate interosseous compartments.Correct Answer: 9

3241. (1513) Q8-1904:

A 32-year-old man is involved in a motorcycle accident and sustains an open tibia fracture. The wound measures 0.5 cm in length. Radiographs demonstrate a transverse midshaft tibia fracture. He is noted to have dysvascular foot and requires repair of his posterior tibial artery. He is also treated with irrigation and debridement of his open fracture and application of an external fixator after vascular repair. Using the Gustilo-Anderson classification system of open fractures, what is the grade of this open fracture:

1) Type I
3) Type IIIA
2) Type II
5) Type IIIC
4) Type IIIB

As defined in Gustiloâs and Andersonâs paper, a type IIIC jury includes any open fracture that is associated with an arterial injury that is repaired, regardless of the degree of soft tissue injury.

- A type I open fracture consists of a wound less than 1 cm long with minimal soft tissue damage and no sign of crushing injury. The fracture is usually simple, transverse, or short oblique with little comminution.
- A type II open fracture is a laceration more than 1 cm long with no extensive soft tissue damage. There is slight or moderate crush component with moderate contamination and comminution.
- A type IIIA injury includes segmental or severely comminuted fractures from high-energy trauma, regardless of wound size. Soft tissue coverage is adequate despite extensive laceration.
- A type IIIB injury is associated with extensive injury to or loss of soft tissue, with periosteal stripping and exposure of bone, massive contamination, and severe comminution from high-velocity trauma. After debridement and irrigation are complete, a segment of bone is exposed and a local or free flap is needed for coverage.

Correct Answer: Type IIIC

3242. (1514) Q8-1905:

A 50-year-old man is involved in a fall from a ladder and sustains an open tibia fracture. The wound measures 0.5 cm in length. Radiographs demonstrate a transverse midshaft tibia fracture. He is noted to have an absent dorsalis pedis pulse. A vascular surgery consult is obtained, and the anterior tibial artery is lacerated and tied off in surgery. The foot remains well perfused. Using the Gustilo-Anderson classification system of open fractures, what is the grade of this open fracture:

1) Type I
3) Type IIIA
2) Type II
5) Type IIIC
4) Type IIIB

As defined by the Gustilo-Anderson classification, a simple fracture pattern with a 0.5-cm wound is a type I injury. Because the vascular injury does not require repair, it is classified as a type I fracture.

- A type II open fracture is a laceration more than 1 cm long with no extensive soft tissue damage. There is slight or moderate crush component with moderate contamination and comminution.
- A type IIIA injury includes segmental or severely comminuted fractures from high-energy trauma, regardless of wound size. Soft tissue coverage is adequate despite extensive laceration.
- A type IIIB injury is associated with extensive injury to or loss of soft tissue, with periosteal stripping and exposure of bone, massive contamination and severe comminution from high-velocity trauma. After debridement and irrigation are complete, a segment of bone is exposed and a local or free flap is needed for coverage.
- As defined by Gustilo and Anderson, a type IIIC injury includes any open fracture that is associated with an arterial injury that must be repaired, regardless of the degree of soft tissue injury.

Correct Answer: Type I

3243. (1515) Q8-1906:

A 50-year-old man falls from a ladder and sustains an open tibia fracture. The wound measures 0.5 cm in length. Radiographs demonstrate a transverse midshaft tibia fracture. He is noted to have an absent dorsalis pedis pulse. A vascular surgery consult is obtained, and the anterior tibial artery is lacerated and tied off in surgery. The foot remains well perfused. What is the most appropriate course of treatment at this point:

1) Irrigation and debridement followed by external fixation
3) Irrigation and debridement followed by IM nailing using an unreamed technique
2) Irrigation and debridement followed by intramedullary (IM) nailing using a reamed technique
5) Irrigation and debridement followed by open plating
4) Irrigation and debridement followed by cast immobilization

Reamed IM nailing is the correct answer for a type I open tibia fracture. High union rates and low infection rates make this the correct choice.

- External fixation can be used to treat a type I injury, however union rates are higher and final alignment improved with IM nailing.
- A recent prospective study demonstrated that open tibial fractures randomized into reamed and unreamed groups had a similar time to union a larger nail and locking screws however demonstrates a lower failure rate over time.
- Cast treatment provides inadequate stability and limit access to the soft tissue.
- Open plating has fallen out of favor due to stripping of the soft tissue envelope resulting in delayed or nonunion and the associated risk of infection.

Correct Answer: Irrigation and debridement followed by intramedullary (IM) nailing using a reamed technique

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3244. (1516) Q8-1907:

A 32-year-old man is involved in a motorcycle accident and sustains an open tibia fracture. The wound measures 7 cm in length. Radiographs demonstrate a short oblique midshaft tibia fracture with a large butterfly fragment. Minimal damage to his anterior tibialis muscle is debrided. What is the most appropriate course of treatment at this point:

1) Irrigation and debridement followed by external fixation
3) Irrigation and debridement followed by IM nailing using an unreamed technique
2) Irrigation and debridement followed by intramedullary (IM) nailing using a reamed technique
5) Irrigation and debridement followed by open plating
4) Irrigation and debridement followed by cast immobilization

This injury must be treated as a Gustilo-Anderson type II injury. Reamed IM nailing is the correct choice.

- External fixation of a type II injury may result in a longer time to union and an increase in final malalignment.
- Multiple studies demonstrate a similar rate of infection and similar time to union between reamed and unreamed nails for type II and IIIA open fractures.
- Cast treatment provides inadequate stability and limits access to the soft tissue.
- Open plating has fallen out of favor due to stripping of the soft tissue envelope, which results in delayed or nonunion or infection.

Correct Answer: Irrigation and debridement followed by intramedullary (IM) nailing using a reamed technique

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3245. (1517) Q8-1908:

A bull rider at the local rodeo has his leg stepped on when dismounting a bull in the rodeo arena. He sustains an open tibia fracture. The wound measures 1 cm in length. Radiographs demonstrate a transverse midshaft tibia fracture with an associated fibula fracture. Following irrigation, debridement, and intramedullary nailing, the most appropriate antibiotic regimen for prevention of infection is:

1) Cefazolin
3) Cefazolin, gentamicin, and penicillin
2) Cefazolin and gentamicin
5) Ciprofloxacin
4) Aminoglycoside and penicillin

By definition, this is a âbarnyardâ injury, which categorizes it as a Gustilo-Anderson type IIIA injury. A type IIIA injury is appropriately treated with a first-generation cephalosporin and an aminoglycoside. Penicillin is added because it is a barnyard injury.

- Cefazolin is appropriate for type I and II open fractures.
- Cefazolin and gentamicin are used for type III open fractures.
- An aminoglycoside and penicillin are not appropriate for any category of open fracture.
- A recent study demonstrated that single-agent antibiotic therapy with ciprofloxacin is effective in treatment of type I and II open fracture wounds. However, ciprofloxacin alone is not recommended when compared to a first-generation cephalosporin and an aminoglycoside in treating type III open fractures.

Correct Answer: Cefazolin, gentamicin, and penicillin

3246. (1518) Q8-1909:

A 32-year-old man is involved in a motorcycle accident and sustains an open tibia fracture. The wound measures 7 cm in length. Radiographs demonstrate a short oblique midshaft tibia fracture with a large butterfly fragment. He has minimal damage to his anterior tibialis muscle that is debrided. His injury is considered as a Gustilo-Anderson type IIIA based on degree of periosteal stripping. He is treated with irrigation debridement and an intramedullary nail using an unreamed technique. What is the most appropriate antibiotic regiment at this point:

1) Cefazolin
3) Cefazolin, gentamicin, and penicillin
2) Cefazolin and gentamicin
5) Ciprofloxin
4) Aminoglycoside and penicillin

A type IIIA injury is appropriately treated with a first-generation cephalosporin and an aminoglycoside.

- Cefazolin is appropriate for type I and II open fractures.
- Cefazolin and gentamicin are used for type III open fractures.
- An aminoglycoside and penicillin are not appropriate for any category of open fracture.
- A recent study demonstrated that single-agent antibiotic therapy with ciprofloxacin is effective in treatment of type I and II open fracture wounds. However, ciprofloxacin alone is not recommended when compared to a first-generation cephalosporin and an aminoglycoside in treating type III open fractures.

Correct Answer: Cefazolin and gentamicin

3247. (1519) Q8-1910:

A bull rider at the local rodeo has his leg stepped on when dismounting a bull in the rodeo arena. He sustains an open tibia fracture. The wound measures 1 cm in length. Radiographs demonstrate a transverse midshaft tibia fracture with an associated fibula fracture. Utilizing the Gustilo-Anderson classification system of open fractures, what type of open fracture is this:

1) Type I
3) Type IIIA
2) Type II
5) Type IIIC
4) Type IIIB

An open wound of any size sustained in a barnyard, resulting from a gunshot wound, or a segmental fracture is considered a type IIIA open wound.

- A type I open fracture is <1 cm and clean.
- A type II open fracture is 1 cm to 10 cm and clean and does not have extensive soft tissue damage.
- A type IIIB open fracture is any size wound requiring a flap for coverage.
- A type IIIC open fracture is any size wound requiring a vascular repair.

Correct Answer: Type IIIA

3248. (1520) Q8-1911:

Tibia fractures in the proximal metaphysis treated with intramedullary nailing are most often complicated by which of the following deformities:

1) Varus
3) Procurvatum and varus
2) Valgus
5) Recurvatum
4) Procurvatum and valgus

The tendency for a medial and anterior nail entrance angle in a proximal third tibia fracture produces a procurvatum and valgus deformity. In addition, the pull of the quadriceps tendon, which is typically on the proximal fragment, tends to produce an apex anterior deformity.

- Varus deformity is not generally a problem with proximal third tibia fractures.
- Valgus is a common deformity in combination with an apex anterior deformity.
- Although procurvatum is a correct choice, procurvatum and varus is not the typical deformity.
- The pull of the quadriceps tendon produces procurvatum, not recurvatum.

Correct Answer: Procurvatum and valgus

3249. (1521) Q8-1912:

Closed tibia fractures with an intact fibula treated with casting or cast bracing are most often complicated by which of the following:

1) Nonunion
3) Valgus malunion
2) Varus malunion
5) Pulmonary embolism
4) Infection

An intact lateral strut tends to push the fracture into varus angulation.

- Although nonunion is a complication of tibia fractures with an intact fibula, varus malunion is more common.
- The intact fibula pushes the fracture into varus, not valgus.
- Infections are not a common complication of closed tibia fractures.
- Pulmonary emboli occur but not as frequently as varus malunion.

Correct Answer: Varus malunion

3250. (1522) Q8-1913:

What type of deformity following closed management of a tibia fracture is most poorly tolerated:

1) Valgus
3) Procurvatum
2) Varus
5) ranslation
4) Recurvatum

Because of the limited eversion of the ankle and hindfoot, varus deformity is poorly tolerated in healed tibia fractures.

- The ankle and hindfoot can invert enough to compensate for some valgus deformity.
- Dorsiflexion of the ankle will correct minor procurvatum.
- Plantarflexion of the ankle allows the patient with a recurvatum deformity to walk with a flat foot.
- As long as the fracture heals, translation is fairly well tolerated.

Correct Answer: Varus

3251. (1523) Q8-1914:

Following what length of time is a tibia fracture considered a nonunion:

1) 3 months
3) 7 months
2) 5 months
5) 12 months
4) 9 months

A tibia fracture takes approximately 4 to 5 months to heal. A nonunion is considered to be about twice the normal healing time, although extraneous circumstances (e.g., diabetes and peripheral vascular disease) may extend this time frame.

- In most healthy patients, tibia fractures take at least 4 months to heal and would not be considered a nonunion at 3 months.
- Five months is the average amount of time for a tibia fracture to heal, not a nonunion.
- Seven months might be considered a delayed union but not a nonunion.
- A nonhealed tibia fracture at 12 months is considered a nonunion, but in a healthy adult it would be considered a nonunion sooner.

Correct Answer: 9 months

3252. (1524) Q8-1915:

What is the average healing time for a tibia fracture:

1) 3 months
3) 7 months
2) 5 months
5) 12 months
4) 9 months

A tibia fracture takes approximately 4 to 5 months to heal, although certain extraneous circumstances (eg, diabetes and peripheral vascular disease) may extend this time frame.

- Although some patients will heal in 3 months, this is not the average.
- Although some healthy patients will take 7 months to heal, this is not the average.
- Nine months is considered a nonunion if a tibia fracture is not healed.
- Twelve months is well beyond the normal healing time for a tibia fracture.

Correct Answer: 5 months

3253. (1525) Q8-1916:

What is the most appropriate soft tissue coverage option for a type IIIB open tibia fracture located in the mid-third of the tibia:

1) Gastrocnemius rotational flap
3) Split-thickness skin graft
2) Soleus rotational flap
5) Sural fasciocutaneous rotational flap
4) Rectus free flap

The most appropriate soft tissue coverage for an open wound of the mid-third of the tibia is a soleus rotational flap.

- A gastrocnemius flap is not likely to cover the mid-third of the tibia.
- A split-thickness skin graft is not appropriate for exposed bone.
- A rectus free flap will work but is considerably more morbid than a local rotational flap.
- A sural fasciocutaneous flap will not likely reach the mid-third of the tibia.

Correct Answer: Soleus rotational flap

3254. (1526) Q8-1917:

What is the most appropriate soft tissue coverage option for a type IIIB open tibia fracture located in the distal third of the tibia:

1) Gastrocnemius rotational flap
3) Split-thickness skin graft
2) Soleus rotational flap
5) Sural fasciocutaneous rotational flap
4) Free flap

The most appropriate soft tissue coverage for an open wound of the distal third of the tibia is a free flap.

- A gastrocnemius flap is not likely to cover the distal third of the tibia.
- A split-thickness skin graft is not appropriate for exposed bone.
- A sural fasciocutaneous flap will not likely reach the distal third of the tibia.

Correct Answer: Free flap

3255. (1527) Q8-1918:

When reconstructing a tibial pilon fracture with internal fixation, which of the following is the first step in fixation:

1) The metaphyseal defect is augmented with bone graft.
3) The fibula is reduced and plated.
2) The articular surface is reconstructed and fixed.
5) A neutralization plate is applied to the tibia.
4) A buttress plate is applied to the anterior or medial tibia.

As described in the classic article by RuÃ«di, the first step is fixation of the fibula to restore length, followed by reconstruction of the articular surface, then stabilization of the metaphyseal defect with bone graft, and finally, restoration of length in the tibia by fixing the metaphysis to the diaphysis with a buttress plate.Correct Answer: The fibula is reduced and plated.

3256. (1528) Q8-1919:

What percentage of tibial pilon fractures progresses to ankle fusion as a late salvage:

1) 10%
3) 50%
2) 20%
5) 90%
4) 75%

Most published series report an arthrodesis rate of 10% to 30%. Although there is an excellent rate of fixation and anatomic reduction, a significant number of patients progress to degenerative arthritis.Correct Answer: 20%

3257. (1529) Q8-1920:

An individual sustains a both-bone forearm fracture, clavicle fracture, tibia fracture, femur fracture opposite the tibia fracture, and a talar neck fracture. All fractures were fixed appropriately. Which of these fractures will cause the most long-term disability:

1) Both-bone forearm fracture
3) Tibia fracture
2) Clavicle fracture
5) Talar neck fracture
4) Femur fracture

Talar neck fractures are the most common fracture of the talus. Because no tendons or muscles attach to the talus, the blood supply is tenuous and there is a high incidence of avascular necrosis (AVN). The risk of AVN is based on Hawkinsâ classification with type I having a 10% risk and type IV having an AVN risk approaching 100%. Other complications include delayed union, nonunion, and malunion.

- Although tibia, femur, and forearm fractures have a risk of nonunion or malunion, they generally heal with minimal long-term complications.
- Most clavicle fractures heal uneventfully without long-term sequelae (nonunion rate of 0.8%).

Correct Answer: Talar neck fracture

3258. (1530) Q8-1921:

How much blood is most commonly lost in an isolated closed femoral shaft fracture:

1) 200 cc
3) 1,000 cc
2) 450 cc
5) 4,000 cc
4) 2,000 cc

Although the range of blood loss from an isolated closed femoral shaft fracture is 500 cc to 2,500 cc of blood, the most common amount of blood loss is 1,000 cc.Correct Answer: 1,000 cc

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3259. (1531) Q8-1922:

A 45-year-old man sustained a femoral neck fracture that was treated with open reduction internal fixation with three cannulated screws. He developed a progressive shortening of the involved limb, and his radiographs are consistent with varus collapse and an obvious nonunion of his femoral neck fracture. The most appropriate next step in the management of this patient is:

1) Magnetic resonance image scan
3) Total hip arthroplasty
2) Valgus osteotomy (Pauwels)
5) Unipolar hemiarthroplasty
4) Bipolar hemiarthroplasty

The decision as to how to proceed after a femoral neck nonunion is based on consideration of a patientâs age, function, medical history, and bone density. Overall rates of osteonecrosis approach 10% for nondisplaced fractures and up to 40% in displaced fractures. Nonunion rates are higher in displaced femoral neck fractures and range from 10% to 30%. Nonunion is defined as no evidence of healing 12 months post-injury. A magnetic resonance image is the study of choice to look for avascular necrosis (AVN) of the femoral head. The presence or absence of AVN and the degree of head involvement dictates treatment.

- Valgus osteotomy is a good option in a patient with a varus nonunion, even with AVN involving up to 50% of the femoral head. This is the best option in patients younger than 55 years old.
- Total hip arthroplasty is a good option in a patient with preexisting rheumatoid arthritis or osteoarthritis involving the acetabular component of the hip joint. This would be the next option in this patient if he had AVN in more than 50% of his femoral head.
- A bipolar hemiarthroplasty is not the best option for this patient. A bipolar hemiarthroplasty would be indicated in a sedentary patient with poor bone stock.
- A unipolar hemiarthroplasty is indicated for a patient who is nonambulatory with low life expectancy and poor bone stock.

Correct Answer: Valgus osteotomy (Pauwels)

3260. (1532) Q8-1923:

A 45-year-old man sustained a femoral neck fracture that was treated with three cannulated screws. He developed progressive shortening of the involved limb, and his radiographs are consistent with varus collapse and nonunion of his femoral neck fracture. A magentic resonance image was obtained by the referring physician and demonstrated avascular necrosis (AVN) of 40% of the femoral head. The most appropriate next step in the management of this patient is:

1) Observation
3) Total hip arthroplasty
2) Valgus osteotomy (Pauwels)
5) Unipolar hemiarthroplasty
4) Bipolar hemiarthroplasty

In this patient who has an established nonunion after being treated with open reduction internal fixation and subsequent AVN of a portion of the femoral head, valgus osteotomy is a good option even with AVN involving up to 50% of the femoral head. This is the best option in patients younger than 55 years old.

- Observation is not a good option because it does not treat the underlying problem and would lead to permanent disability.
- Total hip arthoplasty is an excellent option in patients with extensive AVN or patients older than 55 years of age.
- Bipolar hemiarthroplasty is indicated in an older patient as the primary form of treatment.
- Unipolar hemiarthroplasty is indicated in an elderly person who is nonambulatory.

Correct Answer: Valgus osteotomy (Pauwels)

3261. (4044) Q8-1924:

A 16-year-old girl arrives in your office 3 years after sustaining a comminuted right femur fracture with intramedullary (IM) nail fixation. She is complaining of moderate low back pain. On physical examination, you note that she has a 3-cm leg length discrepancy, and radiographs confirm that the right femur has healed 3 cm short. The most appropriate treatment at this point is:

1) Shoe lift on the right
3) Limb shortening of the left femur
2) Limb lengthening of the right femur
5) Left leg epiphysiodesis
4) Observation

Leg length discrepancy is a complication associated with pediatric femur fractures. Generally, discrepancies less than 2 cm can be observed and treated with shoe lifts. Discrepancies of 2 cm to 5 cm can be treated with shortening of the long side, usually using an IM saw and fixation with an IM nail.

- A shoe lift on the right is not recommended for a discrepancy more than 2 cm.
- Limb lengthening of the right femur is an option, but it would not be the first-line treatment in this situation. Limb lengthening would be indicated if the discrepancy were more than 5 cm.
- In this scenario, a left leg epiphysiodesis would not be the best option because of the lack of remaining growth in this skeletally mature girl.
- Observation is not a viable option because it is only indicated if the discrepancy is less than 2 cm.

Correct Answer: Limb shortening of the left femur

3262. (1533) Q8-1925:

An 18-year-old woman arrives in your office 3 years after sustaining a comminuted right femur fracture treated with intramedullary (IM) nail fixation. She is complaining of moderate low back pain. On physical examination, you note that she has an 8-cm leg length discrepancy, and radiographs confirm that the right femur has healed 8 cm short. The most appropriate treatment at this point is:

1) Shoe lift on the right
3) Limb shortening of the left femur
2) Limb lengthening of the right femur
5) Left leg epiphysiodesis
4) Observation

The patient in question is at skeletal maturity. The approach to leg length discrepancies (LLD) depends on the length difference between the limbs. Discrepancies of more than 4 cm to 5 cm are treated with lengthening. Distraction is usually at the rate of 1 mm/day and is achieved by using Ilizarov principles, including metaphyseal corticotomy (preservation of the medullary canal and blood supply) and gradual lengthening. Lengthening over an IM nail may decrease the time in a distraction device.

- A shoe lift is reserved for differences less than 2 cm.
- The patient is at skeletal maturity so epiphysiodesis is not an option.
- Limb shortening of the unaffected limb is reserved for limb discrepancies of 2 cm to 5 cm.
- Observation is unlikely to change the patientâs symptoms.

Correct Answer: Limb lengthening of the right femur

3263. (1534) Q8-1926:

An 18-year-old woman arrives in your office 3 years after sustaining a comminuted right femur fracture treated with intramedullary (IM) nail fixation. She is complaining of moderate low back pain. On physical examination, you note that she has a 1.5-cm leg length discrepancy, and radiographs confirm that the right femur has healed 1.5 cm short. The most appropriate treatment at this point is:

1) Shoe lift on the right
3) Limb shortening of the left femur
2) Limb lengthening of the right femur
5) Left leg epiphysiodesis
4) Observation

Generally, leg length discrepancies less than 2 cm in mature adults are ignored or treated with shoe lifts.

- Limb lengthening is appropriate when the discrepancy is more than 5 cm.
- Limb shortening of the unaffected limb is reserved for limb discrepancies of 2 cm to 5 cm.
- Observation would not be appropriate due to the patientâs pain.
- The patient is at skeletal maturity so an epiphysiodesis is not an option.

Correct Answer: Shoe lift on the right

3264. (1535) Q8-1927:

A 35-year-old woman presents 6 months after sustaining a fracture of the right ulna when struck by a softball. She was treated in a fracture brace for the past 6 months and continues to complain of pain at the fracture site. Radiographs demonstrate a hypertrophic nonunion with normal findings at the elbow and wrist and no significant ulna deformity. The surgical treatment plan at this point is:

1) Intramedullary (IM) nail fixation of the ulna
3) Bone stimulator and continued bracing
2) External fixation of the ulna
5) Compression plating without bone grafting
4) Compression plating with bone grafting

Hypertrophic nonunions are rich in callus and have a rich blood supply in the ends of the fragments. They result from unstable situations. Union is obtained by providing a stable environment for fracture healing with compression plating. Bone grafting is not required because hypertrophic nonunions have suitable biology and blood supply for healing.

- The IM nail provides only relative stability and not absolute stability necessary for the healing of a hypertrophic nonunion.
- While compression is possible with an external fixator, it only provides a condition of relative stability and many inherent problems with this device preclude its normal use in the treatment of hypertrophic nonunions without deformity.
- This patient has failed standard treatment for this fracture over a significant time frame. Continued use of a fracture brace will unlikely produce union. While a bone growth stimulator has potential to promote union, the literature is sparse and the outcome is uncertain when compared to compression plating.

Correct Answer: Compression plating without bone grafting

3265. (1536) Q8-1928:

A 35-year-old woman presents with a fracture of the right ulna when struck by a softball. Radiographs demonstrate a fracture of the ulna at the junction of the middle and distal third. Radiographs of the elbow and wrist are normal. The ulna is 25% translated and has 9% of apex radial angulation with no shortening. The treatment plan at this point is:

1) Intramedullary nail fixation of the ulna
3) Open reduction internal fixation (ORIF) with plate
2) External fixation of the ulna
5) Observation
4) Functional bracing

Ulna fractures sustained from a direct blow and not associated with radial head subluxation can be treated conservatively. Functional bracing or treatment with casting yields 95% to 98% union rates.

- In cases with displacement of more than 50%, angulation of more than 10Â° to 11Â°, or significantly comminuted and shortened, ORIF with compression plating is most appropriate.
- Other forms of fixation are considered less optimal.
- Observation does little to protect the fracture and control pain.

Correct Answer: Functional bracing

3266. (1537) Q8-1929:

A 40-year-old woman falls on her outstretched left arm. She is point tender over her radial head and at her wrist. She is painful to range of motion at her elbow and cannot significantly move her elbow. Radiographs demonstrate a severely comminuted displaced radial head (Mason type III) fracture with significant step off in the joint. The best treatment plan for this patient is:

1) Sling and early range of motion
3) Radial head replacement
2) Cast for 6 weeks
5) Excision of radial head
4) Open reduction and internal fixation

Radial head replacement is recommended over radial head excision for highly comminuted radial head fractures with injury to medial collateral ligament or distal radioulnar joint.

- Early mobilization should be considered for stable, minimally displaced fractures that involve less than one-third of the articular surface and have no limitation in motion.
- Nondisplaced fractures without limitation in motion involving more than one-third of the articular surface should be treated with splint/sling for a minimum of 2 weeks followed by protected functional activities for an additional 7 to 10 days.
- Comminuted fractures of the radial head are more commonly associated with higher energy trauma and, therefore, are rarely amenable to stable internal fixation.
- Radial head resection is the most commonly performed procedure for comminuted fractures; however, it is associated with instability and late posttraumatic arthritis when performed in the setting of medial collateral ligament or interosseous membrane disruption.

Correct Answer: Radial head replacement

3267. (1538) Q8-1930:

When evaluating a patient for pyogenic flexor tenosynovitis, the diagnosis is often considered when Kanavel signs are present. Which of the following is not a Kanavel sign:

1) Fusiform swelling
3) Pain with passive range of motion
2) Purulence on aspiration
5) Digit in a flexed position
4) Pain along the flexor sheath

Kanavelâs four signs include:

1. Flexed position of finger
2. Symmetric enlargement of whole finger
3. Excessive tenderness over the course of the sheath but limited to the sheath
4. Pain with passive extension finger, most marked at the proximal end

Aspiration of the tendon sheath is not considered a Kanavel sign.Correct Answer: Purulence on aspiration

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3268. (1539) Q8-1931:

When draining pyogenic flexor tenosynovitis of the index finger, in addition to the incision in the palm, the other most appropriate location of the incision is:

1) Dorsal digit
3) Lateral ulnar aspect of digit
2) Volar digit
5) Wrist
4) Lateral radial aspect of digit

A midaxial incision is made in the finger, usually ulnar side to avoid the tactile portion of the index finger that is used to pinch.

- A dorsal incision does not provide easy access to the flexor tendon.
- A radial side incision is used for the thumb and small finger.
- An incision at the wrist does not allow for drainage of the flexor tendon sheath of finger.

Correct Answer: Lateral ulnar aspect of digit

3269. (1540) Q8-1932:

What bacteriae infection is likely to develop following a nail puncture wound to the sole of a foot through a tennis shoe:

1) *Staphylococcus aureus*
3) *Pseudomonas*
2) *Eikenella corrodens*
5) *Clostridium perfringens*
4) *Escherichia coli*

Pseudomonas is the most common cause of infection after a puncture wound through the sole of a shoe, accounting for up to 90% of all infections.

- Staphylococcus aureus is a common cause of orthopedic infections (e.g., cellulitis and osteomyelitis).
- Eikenella corrodens is associated with human bites.
- Escherichia coli is not common in orthopedic infections. It may be isolated in postoperative wounds.
- Clostridium perfringens is found in grossly contaminated traumatic wounds.

Correct Answer: *Pseudomonas*

3270. (1541) Q8-1933:

What percentage of individuals who present with avascular necrosis (AVN) of the femoral head with an apparent idiopathic etiology will develop AVN in the contralateral hip:

1) 10%
3) 50%
2) 25%
5) 90%
4) 75%

Bilateral AVN is present in 34% to 72% of patients who present with idiopathic etiology.Correct Answer: 50%

3271. (1542) Q8-1934:

What imaging modality is the most sensitive for diagnosing asymptomatic avascular necrosis (AVN) of the femoral head:

1) Plain radiographs
3) Ultrasound
2) Bone scan
5) Computerized tomography scan
4) Magnetic resonance image

Magnetic resonance imaging (MRI) is the most accurate imaging modality used for the diagnosis of AVN of the femoral head. MRI sensitivity is between 88% and 100%.

- Plain radiographs are the first step after the history and physical examination for symptomatic disease. Stage 1 disease shows no changes on radiograph, but patients have clinical symptoms.
- Bone scan may be used to evaluate âsilentâ osteonecrosis; however, MRI has a 10% to 20% higher sensitivity.
- Doppler ultrasound has been used to study blood flow to the femoral head, but this has not been well established.
- Computerized tomography scan is useful for detecting early stages of disease (II or III) without collapse.

Correct Answer: Magnetic resonance image

3272. (1543) Q8-1935:

What laboratory test will be most sensitive for determining long-term response to antibiotic therapy in a child with a diagnosis of hematogenous osteomyelitis:

1) Magnetic resonance imaging (MRI)
3) Erythrocyte sedimentation rate (ESR)
2) Bone scan
5) White blood cell (WBC) count
4) C-reactive protein (CRP)

CRP elevation begins within 4 to 6 hours, peaks at 36 to 50 hours, closely parallels acute response with 4 to 7 hours half life, allowing return to normal 3 to 7 days after stimulus is withdrawn. Serial measurements of CRP are a logical option for routine use in conjunction with other clinical and laboratory data in evaluating children with acute hematogenous osteomyelitis.

- MRI and bone scan are not laboratory tests.
- ESR rises more slowly and may not return to normal for weeks despite clinical improvement.
- WBC counts are poor indicators of infection.

Correct Answer: C-reactive protein (CRP)

3273. (1544) Q8-1936:

A 65-year-old man with long-standing osteomyelitis of his right tibia, small vessel peripheral vascular disease, and diabetes presents with increasing drainage and pain from a sinus tract in his mid tibia. He has received antibiotics, but there is no improvement, and drainage and pain are becoming more severe. The best treatment option for this patient is:

1) Intravenous (IV) antibiotics and observation
3) Local debridement and IV antibiotics
2) Radical debridement, soft tissue coverage, and IV antibiotics
5) Below the knee amputation
4) Observation

Amputation is infrequently performed on patients with osteomyelitis. However, in certain patients it may be preferable to multiple operations that are unlikely to eradicate the infection. Arterial insufficiency, major nerve paralysis, or joint contractures and stiffness that make the limb nonfunctional are indications for amputation. Cases of osteomyelitis associated with malignancy in the sinus tract usually require amputation.Correct Answer: Below the knee amputation

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3274. (1545) Q8-1937:

A 65-year-old woman presents with a complaint of new onset knee pain with no history of trauma. She has a mild effusion, no joint line tenderness, and no instability. During examination, she is afebrile. The most likely diagnosis is:

1) Degenerative meniscus tear
3) Avascular necrosis of the femoral condyle
2) Stress fracture
5) Gout
4) Septic arthritis

Degenerative tears of the meniscus tend to occur in patients older than 40 years of age with an atraumatic history of mild joint swelling, mild joint line pain, and mechanical symptoms.

- Stress fractures are commonly found in individuals who place a high demand on their lower extremities. History usually reveals recent increase in impact loading. Clinically, the patient has pain, swelling, tenderness, and increased warmth.
- Avascular necrosis of the femoral condyle results in pain and loss of knee motion, and is usually associated with systemic disease.
- Hallmarks of acute septic arthritis include pain with passive motion, swelling, and erythema. Patients may complain of fever and chills.
- Gout results in an erythematous, painful joint. The attack is often sudden and involves a single joint. The joint is swollen, hot, and tender.

Correct Answer: Degenerative meniscus tear

3275. (1546) Q8-1938:

What type of skin graft is least likely to contract over time:

1) Split thickess skin graft of 0.012 inch thickness meshed
3) Split thickess skin graft of 0.012 inch thickness not meshed
2) Split thickess skin graft of 0.018 inch thickness meshed
5) Full thickness skin graft
4) Split thickess skin graft of 0.018 inch thickness not meshed

Full thickness skin grafts do not contract a minimal amount when compared to partial thickness grafts.

- The thinner the graft, the more wound contracture.
- Meshing increases the surface area that can be covered and allows for drainage of hematomas.

Correct Answer: Full thickness skin graft

3276. (1547) Q8-1939:

A 40-year-old woman falls on her outstretched left arm. She is point tender over her radial head. She is not tender at her wrist. She is painful to range of motion at her elbow but demonstrates no limitation in motion. Radiographs demonstrate a radial head fracture with 1 mm step off involving approximately 30% of the joint surface. The treatment plan at this time is:

1) Sling and early range of motion
3) Cast for 3 weeks
2) Cast for 6 weeks
5) Excision of radial head
4) Open reduction internal fixation (ORIF)

Early mobilization should be considered for stable minimally displaced fractures that involve less than one-third of the articular surface and have no limitation in motion.

- Nondisplaced fractures without limitation in motion involving more than one-third of the articular surface should be treated with splint/sling for a minimum of 2 weeks, followed by protected functional activities for an additional 7 to 10 days.
- Displaced fractures without associated injury are preferably treated by ORIF.
- If ORIF is not feasible, then excision of the radial head may be attempted.

Correct Answer: Sling and early range of motion

3277. (1558) Q8-1950:

Union rates of the femur after antegrade or retrograde reamed intramedullary nailing are:

1) Higher for antegrade nailing
3) Identical
2) Higher for retrograde nailing
5) None of the above
4) Dependent on location in the bone

Several studies have compared antegrade with retrograde nailing. When controlled for canal fit and degree of reaming, the biological effects of antegrade and retrograde nailing on union are identical. The entry portal is irrelevant to union of the fracture.Correct Answer: Identical

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3278. (1559) Q8-1951:

Retrograde nailing when compared to antegrad nailing has:

1) A higher incidence of knee and hip pain.
3) There is no significant difference in joint function.
2) A lower incidence of knee and hip pain.
5) None of the above
4) A higher incidence of knee pain and a lower incidence of hip pain.

The major functional difference between antegrade and retrograde nailing is the incidence of hip vs knee pain. Because researchers often do not prospectively review the incidence of hip vs knee pain in patient outcomes, antegrade and retrograde nailing literature is inconsistent. Knee pain is 36% in retrograde nailing and 9% in antegrade femoral nailing. Hip pain is 4% in retrograde nailing and 10% in antegrade nailing.Correct Answer: A higher incidence of knee pain and a lower incidence of hip pain.

3279. (4045) Q8-1952:

When treating supracondylar fractures of the distal humerus in adults, the optimal fixation must include:

1) Lag screw fixation of the condyles
3) Perpendicular plating of medial and lateral condyles
2) Medial and lateral posterior plates
5) None of the above
4) Routine bone grafting

The distal humerus is flat and wide, and the ability of a plate to hold a wide bone is limited. 90/90 plates provide angular control in two planes, which significantly adds to the stability of the fracture construct. This is necessary to allow early motion and minimize the risk of implant fatigue.Correct Answer: Perpendicular plating of medial and lateral condyles

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3280. (1560) Q8-1953:

When performing reamed antegrade femoral nailing of a transverse midshaft diaphyseal fracture, it is appropriate to:

1) Insert locking screws only if the fracture appears intraoperatively unstable after nail insertion.
3) Insert proximal and distal locking screws.
2) Avoid extra surgical exposure and insert a nail without locking screws.
5) None of the above
4) Only insert locking screws if the fracture requires them intraoperatively.

Brumback and colleagues showed that approximately 10% of fractures have unrecognized comminutions. Comminutions cause fractures to shorten and externally rotate in the immediate postoperative period, which may lead to malunion. Malunion is prevented by the insertion of locking screws.Correct Answer: Insert proximal and distal locking screws.

3281. (1561) Q8-1954:

The insertion of static locking screws with reamed antegrade femoral nailing is associated with:

1) Increased union time
3) No change in malunion rates with stable fractures
2) Delayed weight bearing
5) None of the above
4) No effect on union time or weight bearing.

Static locking of femoral shaft fractures does not retard bone union or delay time to full weight bearing. The advantages of static locking screws include prevention of malunion and early patient mobilization.Correct Answer: No effect on union time or weight bearing.

3282. (1562) Q8-1955:

Reamed antegrade intramedullary nailing of the humerus is associated with:

1) Increased infection rates
3) Increased rates of nonunion
2) Increased rates of iatrogenic comminution
5) None of the above
4) A, B, and C

Reaming of the humerus thins the cortex and prevents revascularization, which results in thin bone that does not have ability to heal. Reamed antegrade nailing of the humerus must be avoided and only nonreamed antegrade intramedullary nailing should be attempted.Correct Answer: A, B, and C

3283. (1563) Q8-1956:

Antegrade femoral nailing in polytrauma patients with chest injuries should be:

1) Performed without reaming
3) Avoided acutely
2) Performed with reaming
5) None of the above
4) Delayed until the pulmonary injury has completed resolved.

Reamed femoral nailing in a patient with an acute pulmonary injury does not add to pulmonary complications or the incidence of acute respiratory distress syndrome (ARDS). Stabilize the fracture and mobilize the patient with any available technique. Studies from Germany show an approximate 35% incidence of ARDS in polytrauma patients who undergo antegrade reamed femoral nailing. Studies from the United States have not corroborated these results, and show a 5% to 8% incidence of ARDS.Correct Answer: Performed with reaming

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3284. (1564) Q8-1957:

A 95Â° blade plate should be used with which of the following fractures:

1) A comminuted supracondylar femur fracture with intercondylar extension.
3) A supracondylar femur fracture without extension into the knee joint.
2) A comminuted supracondylar femur fracture without extension and 2 cm of intact bone in an elderly patient.
5) A supracondylar femur fracture with intracondylar comminution.
4) A contaminated supracondylar femur fracture without intracondylar extension.

Although blade plates are technically demanding, they are useful for fixation of fractures. To correctly use the device, there must be at least 2 cm of intact distal bone for adequate fixation, as well as correct blade placement in three planes. Blade plates are contraindicated in osteopenic bone and fractures with intracondylar comminution. Blade plates are the most stable of the fixation devices and provide excellent varus and valgus alignment.Correct Answer: A comminuted supracondylar femur fracture without extension and 2 cm of intact bone in an elderly patient.

3285. (1565) Q8-1958:

Which of the following is not required for use of the dynamic condylar screw (DCS) in a supracondylar femur fracture:

1) 4 cm of intact distal femur or easily reconstructable distal femur
3) Healthy, nonosteoporotic bone
2) Intact medial condyle
5) Fracture without intracondylar extension
4) Intact lateral soft tissue envelope

To obtain adequate fixation using a DCS, at least 4 cm of intact distal femur or easily reconstructable intracondylar femur is necessary as well as an intact medial condyle. If the device is used percutaneously without medial soft tissue stripping, then medial bone grafting is not necessary. Dynamic condylar screws are ideal fixation devices in osteoporotic bone with the use of cement augmentation. The disadvantage to this plate is that the large shoulder can sometimes be prominent on the lateral aspect of the femur.Correct Answer: 4 cm of intact distal femur or easily reconstructable distal femur

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3286. (1566) Q8-1959:

A 35-year-old man sustains a closed tibial pilon fracture. The patient undergoes open reduction internal fixation of the fracture with supplemental external fixation. Which of the following is the most common complication after open fixation:

1) Loss of fixation
3) Osteomyelitis
2) Prominent hardware
5) Nonunion
4) Soft tissue complications

Open fixation of severe tibial pilon fractures can lead to all of the above complications, but soft tissue complications are the most common. Soft tissue complications include wound dehiscence and infections, along with complications of the surrounding tendons.Correct Answer: Soft tissue complications

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3287. (1567) Q8-1960:

Which of the following structures is not found in the greater sciatic foramen:

1) Superior gluteal nerve
3) Piriform muscle
2) Inferior gluteal nerve
5) Internal pudendal artery
4) Obturator nerve

Fourteen structures traverse through the greater sciatic foramen including seven nerves, three sets of vessels, and the piriform muscle. The seven nerves include the sciatic nerve, superior gluteal nerve, inferior gluteal nerve, internal pudendal nerve, posterior femoral cutaneous nerve, nerve to the quadratus femoris, and the nerve to the obturator externus. The three vessels include the superior gluteal artery and vein, inferior gluteal artery and vein, and the internal pudendal artery and vein.Correct Answer: Obturator nerve

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3288. (1568) Q8-1961:

Which of the following devices is contraindicated for fixation of supracondylar femur fractures with intercondylar extension and comminution:

1) Blade plate
3) Condylar plate
2) Less invasive internal skeletal stabilization (LISS) plate
5) Immediate modular hinged total knee arthroplasty
4) Medial and lateral plating

Many devices can be used in fixation of supracondylar femur fractures with intercondylar extension. Each implant has advantages and disadvantages for use in the distal femur. Various devices include blade plates, compression screws, condylar plates, medial and lateral plating, antegrade or retrograde nailing, and the percutaneous plate. In patients with osteoporosis and preexisting arthrosis, the use of a modular replacement arthroplasty can address both the fracture and the arthrosis and provides the most rapid return of function. Intercondylar comminution can best be addressed with the use of dual plating, a condylar plate, and a LISS plate. A blade plate is technically demanding and can cause intercondylar comminution and does not provide stable fixation for fractures with intercondylar comminution.Correct Answer: Blade plate

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3289. (1569) Q8-1962:

Upon awakening, a 34-year-old alcoholic man experienced pain in his left shoulder. The patient holds his arm tightly against his chest and holds his forearm tightly to the trunk. External rotation and abduction are severely limited and painful. Which of the following injuries best accounts for these findings:

1) Luxatio erecta
3) Posterior dislocation of the shoulder
2) Anterior dislocation of the shoulder
5) Proximal humerus fracture
4) Superior dislocation of the shoulder

During electrocutions and seizures, there are uncontrolled muscle contractions that cause a posterior dislocation of the shoulder. The patient in this case has signs of a posterior shoulder dislocation and atraumatic injury most likely because of an alcoholic seizure. The dislocation occurs because the internal rotators of the humerus overpower the external rotators. Superior dislocations are rare and often involve associated fractures of the acromion. Luxatio erecta occurs when there is an inferior humeral head dislocation and the humerus is held alongside the head in full abduction with inability to adduct.Correct Answer: Posterior dislocation of the shoulder

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3290. (1570) Q8-1963:

A 27-year-old man sustains a pelvic injury because of a crush. The patient is hemodynamically unstable despite administration of fluid boluses and packed red blood cells. A diagnostic peritoneal lavage is negative. The next step in the management of this patient is:

1) Computerized tomography scan of the abdomen and pelvis
3) Angiography
2) Pelvic external fixator
5) Pneumatic antishock garment
4) Exploratory laparotomy with open packing

Hemodynamic instability in a patient with blunt polytrauma must be considered a hemorrhage in the abdomen, pelvis, or chest. In the workup of the source of the bleeding, a diagnostic peritoneal lavage (DPL) should be performed to rule out intra-abdominal bleeding. If the DPL is negative and the patient is still hemodynamically unstable, an external fixator must be applied. The external fixator serves several purposes including preventing gross motion, stabilizing the dimensions of the pelvis to aid in tamponade, reducing of cancellous bleeding at the fracture site, and promoting early mobilization.Correct Answer: Pelvic external fixator

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3291. (1571) Q8-1964:

An 11-year-old child sustains a radius and ulna diaphyseal fracture with 40Â° of volar angulation and complete displacement. Manipulation under hematoma block shows 75% apposition of the fractureâs end with 20Â° of volar angulation. The next step in management is:

1) Long arm cast in pronation
3) Open reduction and internal fixation
2) Long arm cast in supination
5) Closed reduction with percutaneous nailing
4) Remanipulation under intravenous sedation with splinting

After manipulation under hematoma block, this fracture remains in unacceptable alignment. In children older than 10 years of age, the amount of acceptable angulation is 15Â°, although anatomic alignment must be attempted. Indications for open reduction include open fractures, failed closed reductions, soft tissue interposition, and malalignment. If the child is between 6 and 10 years old, then 20Â° of angulation is acceptable.Correct Answer: Remanipulation under intravenous sedation with splinting

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3292. (1572) Q8-1966:

Which of the following is an indication for nonoperative fixation of a humeral shaft fracture:

1) Open fracture
3) Segmental fracture
2) Floating elbow
5) Polytrauma patient
4) Radial nerve palsy

A radial nerve palsy alone is not an indication for operative exploration or internal fixation of a humeral shaft fracture unless it occurs after attempted reduction. Indications for operative intervention include open fracture, polytrauma with multiple extremity injuries, a floating elbow, pathological fracture, and segmental injury.Correct Answer: Radial nerve palsy

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3293. (1573) Q8-1967:

In a patient with a thoracolumbar burst fracture, which of the following factors does not necessitate operative treatment:

1) 60% canal compromise without neurological defect
3) Neurological defect
2) 20Â° of kyphosis
5) Rotational injury
4) Posterior spinal tenderness

It is important to differentiate between two-column injuries, which may be treated nonoperatively, and three-column injuries, which usually require operative treatment. It is the opinion of the authors that fractures are stable if they have less than 25Â° of kyphosis and less than 50% canal compromise with no neurological deficit. Also, posterior spinal tenderness along with a rotational or translational injury is indicative of a three-column injury.Correct Answer: 20Â° of kyphosis

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3294. (1574) Q8-1968:

A 22-year-old man sustains a low velocity gunshot wound to the thigh resulting in a comminuted midshaft femur fracture. In addition to antibiotics, management must include:

1) Debridement of skin edges and plating
3) Wide debridement with delayed intramedullary nailing
2) Debridement of skin edges with immediate intramedullary nailing
5) Wide debridement with plating
4) Wide debridement with immediate intramedullary nailing

Most low velocity gunshot wounds do not inflict extensive soft tissue damage nor do they cause a blast-type injury. In the study by Nowotarski and Brumback, intramedullary nailing with underreamed or minial reaming performed immediately does not cause an increase in infection or malunion compared to plating with only superficial debriding of skin edges.Correct Answer: Debridement of skin edges with immediate intramedullary nailing

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3295. (1575) Q8-1969:

A 40-year-old man sustains a posterior hip dislocation with a femoral head fracture below the fovea. After undergoing closed reduction with adequate anesthesia, the hip remains stable. Radiographs and computerized tomography (CT) scans are obtained and reveal a 1-cm displacement of the fracture fragment. The next step in management is:

1) Open reduction internal fixation (ORIF) via anterior approach
3) Skeletal traction
2) ORIF via posterior approach
5) Excision of fragment
4) Mobilization along with protected weight bearing

In Pipkin type 1 and 2 fractures of the femoral head (this patient has a type 1), nonoperative treatment is appropriate if the displacement of the fracture is less than 2 cm on CT scan after reduction. Studies have shown that ORIF or excision in type 1 fractures produces worse results than those treated with simple closed reduction.Correct Answer: Mobilization along with protected weight bearing

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3296. (1657) Q8-2052:

After using external fixation, the infection rate reported in the literature is:

1) 1%
3) 9%
2) 3%
5) 35%
4) 20%

Pin tract infections are the most common complication of external fixation. Even with vigilance and immaculate maintenance of pin site care, the majority of patients will have at least one pin tract infection. Researchers at Ilizarov's institute summarized the complications associated with 3,669 fixator applications from 1970 through 1975. Analyzing wire-tract infections, the researchers found an 8.3% rate of purulent soft tissue sepsis and a 0.2% rate of wire-hole osteomyelitis.Correct Answer: 9%

3297. (1658) Q8-2053:

Which of the following external fixation constructs has the best long-term stability for the treatment of a mid-diaphyseal tibia fracture:

1) A unilateral frame with 1 cm of bone loss
3) A delta frame with 1 cm of bone loss
2) A bilateral frame with 1 cm of bone loss
4) A unilateral frame with bone end abutment

Any external fixation configuration with bone end abutment provides better long-term stability because some portion of the physiological forces are transmitted, which decreases the forces transmitted through the pins and decreases the rate of loosening.Correct Answer: A unilateral frame with bone end abutment

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3298. (1659) Q8-2054:

The bending strength of a pin is proportional to its radius to the:

1) First power
3) Third power
2) Second power
4) Fourth power

Pins are typically the weakest component of an external fixation system. The bending rigidity of each pin is theoretically proportional to the fourth power of the pin diameter, so increasing the pin diameter from 4 mm to 6 mm increases the bending stiffness of each pin by a factor of five.Correct Answer: Fourth power

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3299. (1660) Q8-2055:

An external fixator pin must not exceed what percentage of the diameter of the diaphysis:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

The diameter of any screw hole should be limited to no more than 30% of the diameter of the diaphysis. Studies show that a hole more than 30% of the diameter markedly increases the risk of fracture. A screw hole equal to 30% of the diameter weakens the torsional strength of a bone by 45%. Over 6 to 8 weeks, the bone will remodel about the implant and restore its strength. Upon removal of the screw, however, the weakening recurs until the bone has remodeled again.Correct Answer: 30%

3300. (1661) Q8-2056:

The bending stiffness of an external fixation frame is decreased by:

1) Changing to a hybrid frame
3) Increasing patient weight bearing
2) Axially dynamizing the frame
5) Adding another pin close to the fracture site
4) Increasing the frame-bone distance

Increasing the frame-bone distance decreases stiffness; adding another pin will increase the stiffness.Correct Answer: Increasing the frame-bone distance

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3301. (1662) Q8-2057:

Which of the following is the most important factor in increasing frame rigidity:

1) Increasing the size of the side bar
3) Moving the pins closer to the fracture
2) Increasing the distance between pins
5) Increasing the size of the pins
4) Moving the pins farther from the fracture

Increasing the size of the pin is the most important means to increase frame rigidity.Correct Answer: Increasing the size of the pins

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3302. (1663) Q8-2058:

The primary mode of healing with the use of modern external fixators is primary bone healing.

1) True
2) False

There are two types of fracture healing â union through external periosteal callus and primary bone healing, also known as in situ fracture remodeling. Fracture callus forms in reaction to the disruption of the periosteum and endosteum combined with the interfragmentary strain or motion associated with a bone injury. Callus bridges the fracture fragments and acts as a stabilizing structural framework and the biological substrate that provides the cellular material for union and remodeling. Current external fixation systems are designed to allow micromotion at the fracture site to promote callus formation.Correct Answer: False

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3303. (1664) Q8-2059:

It is important to introduce bending preload when applying external fixators.

1) True
2) False

At one time, researchers believed that bending preload was beneficial (placing the pins under bend and attaching them to the external fixator frame in this position); however, this causes failure of the pins because of rapid pressure necrosis on the compression side of the preloaded pin. Therefore, bending preload is discouraged.Correct Answer: False

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3304. (2008) Q8-2424:

Which of the following constructs produces the strongest biomechanical fixation when treating a displaced talar neck fracture:

1) Two K-wires placed from a posterior to anterior direction
3) One 6.5-mm screw placed from an anterior to posterior direction
2) Two 4.5-mm cancellous screws placed from a posterior to anterior direction
5) Two 4.5-mm cancellous screws placed from an anterior to posterior direction
4) Two K-wires placed from an anterior to posterior direction

Biomechanical evaluations have shown that screws are superior to wires for fixation. Posterior-to-anterior screws insertion is superior to anterior-to-posterior insertion. It has also been demonstrated that two 4-mm screws are equivalent to a one 6.5-mm screw.Correct Answer: Two 4.5-mm cancellous screws placed from a posterior to anterior direction

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3305. (2009) Q8-2425:

In a Hawkins type III or IV open talar neck fracture, the rate of infection is:

1) 5%
3) 89%
2) 13%
5) 67%
4) 38%

Despite surgeonsâ adherence to the principles of treating open fractures, the infection rate (38%) remains high, which correlates with poor functional outcome.Correct Answer: 38%

3306. (2010) Q8-2426:

Which of the following is the best predictor of intact vascularity to the talar body:

1) The presence of subchondral sclerosis on anteroposterior view of the ankle at 6 to 8 weeks
3) Varus malunion of the talar neck
2) Subtalar arthritis
5) Subchondral collapse
4) The presence of subchondral lucency on anteroposterior view of the ankle at 6 to 8 weeks

The first sign of revascularization in subchondral bone is seen approximately 6 weeks after surgery. At this time, radiographs of the talus demonstrate a Hawkins sign â evidence of disuse osteoporosis under the subchondral bone of the talar dome. This osteolysis is an excellent sign of revascularization and weight bearing status should be progressed.Correct Answer: The presence of subchondral lucency on anteroposterior view of the ankle at 6 to 8 weeks

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3307. (2011) Q8-2427:

The reported rate of osteonecrosis in a 21-year-old healthy male athlete who sustains a displaced fracture of the talar neck with displacement of both the subtalar and ankle joint is:

1) Less than 10%
3) Less than 5%
2) Less than 40%
5) 100%
4) Greater than 90%

The Hawkins classification is traditionally used to grade talar neck fractures by the amount of dislocation that has occurred between the body fragments and the neck, the ankle, or the subtalar joint. It is also used to predict the amount of avascular necrosis that may be expected. Depending on the severity of the injury, the risk of avascular necrosis in the body ranges from less than 5% to 90% or more.

In type I, the talar neck fracture is nondisplaced; the risk of avascular necrosis in the body is less than 10%. In type II, the body is slightly displaced from one of the two joints; the risk of avascular necrosis in the body is less than 40%. In type III, the body is displaced from both the ankle and the subtalar joints; the risk of avascular necrosis in the body is greater than 90%. Type IV, which was added by Canale and Kelly and not part of Hawkinsâ original classification, includes subluxation of the head, dislocation of the body from both sides, and extrusion of the body; the risk of avascular necrosis to the body approaches 100%.Correct Answer: Greater than 90%

3308. (2012) Q8-2428:

Radiographic indicators of an abnormal patellotibial relationship include all of the following except:

1) On an anteroposterior radiograph, the distal pole of the patella lies no more than 20 mm above the plane of femoral condyles.
3) On a lateral radiograph, the length of the patella ligament (from the distal pole to the tibial tubercle) approximates that of the patella.
2) On a 90Â° bent knee flexed lateral radiograph, the proximal pole of the patella lies posterior to the anterior surface of the femoral shaft.
5) Blumensaatâs line projects near the distal pole of the patella.
4) A patella to patella ligament ratio is equal to 0.5.

All of the answers above are radiographic indicators of an abnormal patellotibial relationship except that a patella to patella ligament ratio should equal 0.8.Correct Answer: A patella to patella ligament ratio is equal to 0.5.

3309. (2013) Q8-2429:

A 30-year-old woman who was involved in a motor vehicle accident as a restrained driver sustained a midshaft femur fracture, liver laceration, proximal humerus fracture, and a distal both-bone forearm fracture. Early stabilization of the femoral shaft fracture within 24 hours decreases all of the following except:

1) Time until fracture unites
3) Risk for developing adult respiratory distress syndrome
2) Hospital cost
5) Length of stay in intensive care unit
4) Risk for developing pneumonia

In a prospective randomized study, Bone and coworkers demonstrated the beneficial effects of early fracture stabilization (within the first 24 hours) and early immobilization in the multiple-injured patients. They showed that the incidence of acute respiratory distress syndrome, pulmonary dysfunction, pneumonia, and abnormal blood gases was significantly lowered. The investigators also noted that early fixation and mobilization prevented deep venous thrombosis and decubitus ulcer. The literature does not show that the benefits of early fixation of femur fractures in multiple-injured patients decrease the time until the fracture unites.Correct Answer: Time until fracture unites

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3310. (2014) Q8-2430:

A 48-year-old woman was involved in a motor vehicle accident as an unrestrained passenger in which she sustained a thoracic injury and a transverse midshaft femur fracture. Which of the following factors appears to be the most detrimental to the degree of lung dysfunction that will develop:

1) Placing an nonreamed intramedullary nail to stabilize the patientâs femur fracture
3) The severity of the original thoracic injury
2) Placing a reamed intramedullary nail to stabilize the patientâs femur fracture
5) Locking the intramedullary nail
4) Treating with open reduction and plating of the femur fracture

Bosse and colleagues have shown that fixation of long bone fractures has no effect on the severity of the thoracic injury. It appears that the severity of the original thoracic injury determines the degree of lung dysfunction that will develop.

Heim and colleagues found no difference between reamed or unreamed femoral nails in pathophysiologic pulmonary data in rabbits. They showed that the first instrument inserted (the starting awl, guide wire, and first one or two reamers) generates the highest pressures in the femoral canal. Heim also demonstrated that a solid nonreamed nail generated pressures similar to those of the first two reamers.Correct Answer: The severity of the original thoracic injury

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3311. (2015) Q8-2431:

A 57-year-old woman presents with a 4-week history of right hip pain. She has no history of trauma. Her past medical history is significant for osteoporosis. Radiographs that were obtained demonstrate a haze of internal callus at the inferior neck. Treatment should include:

1) Open reduction internal fixation using a compression screw
3) Closed reduction and placement of three percutaneous cannulated screws
2) Closed reduction and placement of a percutaneous cannulated screw
5) Crutch ambulation with toe-touch weight bearing status
4) Hemiarthroplasty

Horiuchi and colleagues demonstrated that compression fractures essentially have no risk of displacement without additional trauma and should be treated with crutch ambulation.Correct Answer: Crutch ambulation with toe-touch weight bearing status

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3312. (2016) Q8-2432:

The critical blood supply to the majority of the weight bearing superior portions of the femoral head is supplied by the:

1) Terminal branch of the lateral femoral circumflex artery
3) Lateral epiphyseal artery
2) Artery of the ligamentum teres
5) Foveolar artery
4) First branch of the medial femoral circumflex artery

The critical blood supply to the majority of the weight bearing superior portions of the femoral head is supplied by the terminal branch of the medial femoral circumflex artery, or lateral epiphyseal artery.Correct Answer: Lateral epiphyseal artery

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3313. (2017) Q8-2433:

A 77-year-old man who lives in a nursing home fell from his wheel chair and landed on his right hip earlier this morning. He presents to the emergency department with a painful right hip to palpation held in external rotation. The patient reports pain with any attempt to move his right hip. His initial radiograph does not demonstrate any fracture or dislocation. Your next step would be to:

1) Obtain a technetium 99 bone scan before the patient leaves the emergency department on the same day
3) Obtain a technetium 99 bone scan within 48 hours of the accident
2) Send the patient back to the nursing home and arrange for follow-up in your office within the next week
5) Obtain a computed tomography image of the right hip while the patient is in the emergency department
4) Obtain a magnetic resonance image of the right hip while the patient is in the emergency department

Rizzo and associates showed that an MRI is superior to bone scanning in the detection of occult hip fractures in the first 48 hours.Correct Answer: Obtain a magnetic resonance image of the right hip while the patient is in the emergency department

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3314. (2018) Q8-2434:

Advantages of the use of intramedullary second-generation nails over plates and screws in treatment of unstable subtrochanteric fractures include all the following except:

1) Intramedullary nails preserve the periosteal blood supply.
3) Intramedullary nails are twice as strong in terms of biomechanical stiffness and strain.
2) Intramedullary nails are load-sharing devices.
5) Intramedullary nails cause fewer varus malunions.
4) Intramedullary nails cause less femoral head cutout.

Kraemer and associates showed that intramedullary devices were superior to plates and screws in that intramedullary devices are load-sharing and biomechanically stronger, and preserve blood supply.

Alvarez and colleagues demonstrated that varus deformities occurred more frequently with the use of an intramedullary nail due to entry points placed too far lateral to the tip of the trochanter.Correct Answer: Intramedullary nails cause fewer varus malunions.

3315. (2019) Q8-2435:

Surgical indications for treatment of a tibial plateau fracture include all the following except:

1) Medial tilt
3) Lateral condyle fracture in 3Âº of valgus
2) Articular incongruity of 5 mm
5) Axial displacement
4) 8 mm of condylar widening

An articular step-off of 3 mm or condylar widening of 5 mm has no adverse effects. Functionality deteriorates with medial tilt, whereas lateral or valgus tilt of up to 5Âº is well tolerated. Bicondylar fractures with axial displacement also should be treated surgically.Correct Answer: Lateral condyle fracture in 3Âº of valgus

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3316. (2020) Q8-2436:

Benefits of antegrade femoral intramedullary nailing over retrograde femoral intramedullary nailing in treatment of closed mid-shaft femur fracture include:

1) Less blood loss
3) Decreased time to union
2) Lower operative time
5) Less hip pain
4) Distal locking screw pain necessitating removal

Ostrum and associates in the largest prospective randomized series of antegrade versus retrograde femoral nailing to date showed that there was no difference in union rates, time to union, knee pain, or range of motion. Blood loss was significantly lower in the retrograde group, and there was a trend toward lower operative time. Hip pain was more common in the antegrade nails, and distal locking screw pain necessitating removal seems to be more common in retrograde nails.Correct Answer: Distal locking screw pain necessitating removal

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3317. (2021) Q8-2437:

Diabetic patients who sustain rotational ankle fractures are highly likely to have higher complications (infection, long-term bracing, and/or malunion/nonunion, BKA) independent of the treatment approach if at the time of injury the patient had documented at least one of the following except:

1) Nephropathy
3) Age older than 55 years
2) Neuropathy
5) Vasculopathy
4) Retinopathy

Yelden, Marsh, and Saltzman demonstrated that diabetic patients who sustain rotational ankle fractures have higher risks for developing complications. Diabetic patients were more likely to require or develop infection, long-term bracing and/or malunion/nonunion, BKA, independent of age, gender, fracture-type, and treatment approach. Diabetic patients are significantly more likely to have one of these outcomes if at the time of presentation they had documented nephropathy, neuropathy, retinopathy, or vasculopathy.Correct Answer: Age older than 55 years

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3318. (2022) Q8-2438:

A 37-year-old woman who is an avid jogger sustains a displaced fracture of the talar neck with displacement of both the subtalar and ankle joints. She was treated with immediate open reduction internal fixation through two incisions. At 13 weeks postinjury, the patientâs fracture radiographically appears to be united and well aligned. Radiographs show evidence of disuse osteoporosis under the superior subchondral bone of the talar dome. Treatment at this time should include:

1) Protected weight bearing
3) A magnetic resonance image to evaluate the boneâs viability
2) Autograft bone grafting of the talar body
5) Application of a bone stimulator
4) Blair fusion

The first sign of revascularization in subchondral bone is seen approximately 6 weeks after surgery. At this time, radiographs of the talus demonstrate a Hawkins sign â evidence of disuse osteoporosis under the subchondral bone of the talar dome. This osteolysis is an excellent sign of revascularization and weight bearing status should be progressed.Correct Answer: Protected weight bearing

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3319. (2023) Q8-2439:

The rigidity of an external fixator can be increased by:

1) Decreasing the distance between the bone and rods
3) Decreasing pin diameter
2) Decreasing the number of pins
5) Increasing the distance between fragment pin sets
4) Separating the half pins by less than 30Âº when applying anterior and anteromedial frames

Many factors determine the rigidity of a frame. The pin holes should be less than 30% of the bone diameter to decrease the risk of open section fracture. The bending stiffness of the pin is proportional to half the radius to the fourth power. Therefore, increasing the pin diameter to less than 30% of the bone diameter will increase the rigidity of the external fixator. Tubular rods with an 11-mm diameter are approximately twice as stiff as solid connecting rods with an 8-mm diameter. Increasing the pin spread within each bone segment to 9 cm triples the resistance to anteroposterior bending. Decreasing the bone rod distance to 2.5 cm leads to a threefold increase in resistance to transverse bending. Another way to increase stiffness of the frame is to separate half pins by greater than 45Â° when applying anterior and anteromedial frames together.Correct Answer: Decreasing the distance between the bone and rods

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3320. (2024) Q8-2440:

Clinical variables associated with a poor outcome following calcaneal fractures include all of the following except:

1) Age older than 50 years
3) History of heavy labor
2) Increased body weight
5) Decreased body weight
4) On workersâ compensation

Paley and associates demonstrated the clinical variables associated with a poor outcome include age older than 50 years, increased body weight, history of heavy labor, and on workersâ compensation.Correct Answer: Decreased body weight

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3321. (2025) Q8-2441:

Radiographic factors correlating with a poor outcome following calcaneal fractures include all of the following except:

1) Subtalar incongruity
3) Increased heel width
2) Arthrosis of the tibiotalar and talonavicular joints
5) Increased Bohler angle
4) Decreased fibulocalcaneal space

The radiographic factors correlating with a poor outcome include subtalar incongruity, arthrosis of the tibiotalar and talonavicular joints, increased heel width, decreased fibulocalcaneal space, and a decreased Bohler angle. Loucks and Buckley reported the correlation between Bohler angle and clinical outcome. An increase in initial displacement, regardless of treatment, results in a less successful outcome.Correct Answer: Increased Bohler angle

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3322. (2026) Q8-2442:

Complications of nonsurgical treatment of calcaneal fractures include all of the following except:

1) Peroneal and saphenous nerve impingement
3) Short and wide heel
2) Hindfoot varus
5) Relative leg length discrepancy
4) Pes planus

Complications of nonsurgical treatment of calcaneal fractures include peroneal and sural (not saphneous) nerve impingement, hindfoot varus, short and wide heel, pes planus, relative leg length discrepancy, and tibiotalar impingement limiting extension.Correct Answer: Peroneal and saphenous nerve impingement

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3323. (2027) Q8-2443:

Which of the following patient-related risk factors is associated with an increased risk for infection after open reduction and internal fixation of calcaneal fractures through standard lateral incision:

1) Obesity
3) Use of systemic steroids
2) History of alcohol abuse
5) Extension of the fracture into the calcaneocuboid joint
4) History of smoking

Folk, Starr, and Early showed a 90% risk of wound problems when a patient who sustained a calcaneal fracture had diabetes, a history of smoking, and an open fracture.Correct Answer: History of smoking

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3324. (2028) Q8-2444:

The location of the lisfranc ligament is between:

1) Middle cuneiform and base of the second metatarsal
3) Medial cuneiform and middle cuneiform
2) Base of second metatarsal and the medial cuneiform
5) Medial cuneiform and base of first metatarsal
4) Base of first metatarsal and middle cuneiform

The lisfranc ligament traverses the base of the second metatarsal to the medial cuneiform.Correct Answer: Base of second metatarsal and the medial cuneiform

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3325. (2029) Q8-2445:

A 22-year-old college basketball player presented with a history of pain along the lateral border of the foot for the past 3 weeks. Radiographs demonstrated intramedullary sclerosis and fracture at the metaphyseal-diaphyseal junction of the fifth metatarsal. Treatment at this point should include:

1) Below-the-knee cast and non-weight bearing
3) Below-the-knee cast and weight bearing as tolerated
2) Soft dressing and weight bearing as tolerated
5) Stiff-soled postoperative shoe with partial weight bearing
4) 4.5-mm intramedullary screw placement

DeLee and associates reported on the early return of 10 athletes with diaphyseal stress fractures treated with closed intramedullary screw fixation. This is adequate treatment for foot stress fractures.Correct Answer: 4.5-mm intramedullary screw placement

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3326. (2030) Q8-2446:

Which of the following structures causes an avulsion fracture of the tuberosity of the fifth metatarsal:

1) Peroneus tertius
3) Lateral band of plantar fascia
2) Peroneus brevis
5) Medial band of plantar fascia
4) Peroneus longus

In a cadaveric study, Richli and Rosenthal implicated the lateral band of plantar aponeurosis as the structure more likely to cause tuberosity avulsion fractures.Correct Answer: Lateral band of plantar fascia

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3327. (2031) Q8-2447:

Thirteen weeks ago, a 42-year-old man sustained a displaced fracture of the talar neck with displacement of both the subtalar and ankle joint. Initially, he underwent open reduction and internal fixation with titanium screws and has been non-weight bearing since the injury occurred. Radiographs of the talus reveal complete union. A magnetic resonance image (MRI) reveals signal changes in 40% of the talus body. Treatment at this point should include:

1) Progress to weight bearing as tolerated
3) Blair arthrodesis
2) Progress to partial weight bearing
5) Talectomy
4) Continue limited weight bearing and repeat the MRI in the next 3 to 6 months

Thordarson and associates used MRI to established criteria for allowing a patient to begin weight bearing. Their study suggested that patients with Hawkins types I and II fractures should be allowed protective weight bearing when radiographic evidence of healing at the fracture is present. None of the patients with a type I or II fracture in this study developed late segmental collapse.

For patients with a Hawkins type III or IV fracture, the investigators recommended an MRI at 8 to 12 weeks postinjury to assess for osteonecrosis. The degree of osteonecrosis is then classified based on the percent of talar body affected by osteonecrosis (type A, homogenous bone throughout the body of the talus; type B, signal changes in up to 25 % of the body of the talus; type C, signal changes in up to 25% to 50% of the body of the talus; and type D, signal changes in more than 50 % of the body of the talus). The fracture presented in this question is a type C. Type C fractures are kept non-weight bearing and the MRI is repeated in 6 to 9 months after injury. If no progression of signal changes is noted, protective weight bearing is allowed.Correct Answer: Continue limited weight bearing and repeat the MRI in the next 3 to 6 months

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3328. (2032) Q8-2448:

A 48-year-old man who was involved in a motor vehicle accident as a restrained passenger sustained an isolated split-depression fracture of his left lateral tibial plateau 8 days ago. Clinical signs indicating that the soft tissue will be more tolerant of an open reduction internal fixation procedure include:

1) The presence of fracture blisters
3) The ability to palpate bony landmarks
2) The presence of extensive subcutaneous hemorrhage or bruising
5) The presence of a large draining open wound over the knee
4) The absence of skin wrinkles

The absence of fracture blisters, the ability to palpate bony landmarks, the presence of skin wrinkles, and the absence of extensive subcutaneous hemorrhage or bruising are clinical signs that help determine the safety of open reduction internal fixation of tibial plateau fractures.Correct Answer: The ability to palpate bony landmarks

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3329. (2033) Q8-2449:

To avoid intra-articular placement of small wires from a hybrid external fixator, tensioned wires or half pins should be kept how far from the articular surface in the knee joint.

1) 3 mm from the articular surface
3) 7 mm from the articular surface
2) 10 mm from the articular surface
5) 14 mm from the articular surface
4) 12 mm from the articular surface

To avoid intra-articular placement of small wires from a hybrid external fixator, tensioned wires or half pins should be kept more than 14 mm from the articular surface. The proximal tibio-fibular joint sometimes communicates with the knee joint.Correct Answer: 14 mm from the articular surface

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3330. (2034) Q8-2450:

The advantages of treating tibial shaft fractures with intramedullary nailing over closed treatment and casting include all of the following except:

1) Time to healing
3) Decreased rate of malunion
2) Rate of healing
5) Increased measures of general health status
4) Decreased functional scores for ankle and knee function

Bone and associates reported that time to healing, rate of healing, decreased rate of malunion, increased functional scores for ankle and knee function, and increased measures of general health status are favored with intramedullary nailing of diaphyseal tibia fractures over closed treatment via casting.Correct Answer: Decreased functional scores for ankle and knee function

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3331. (2035) Q8-2451:

Which of the following is the most common complication associated with the treatment of a closed diaphyseal tibia fracture with an intramedullary nail:

1) Nonunion
3) Infection
2) Compartment syndrome
5) Knee pain
4) Symptomatic hardware

Court-Brown and associates identified anterior knee pain as the most common complication associated with treatment of a closed diaphyseal tibia fracture with an intramedullary nail.Correct Answer: Knee pain

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3332. (2036) Q8-2452:

A 39-year-old man sustained a grade II open diaphyseal tibia fracture that was treated with irrigation and debridement, external fixation, and delayed wound closure 12 weeks ago. At 9 weeks, the patientâs weight bearing status was increased to partial weight bearing and the patient has since reported slight leg pain. Radiographs indicated a comminuted diaphyseal fracture of the tibia with no signs of callus formation. The radiographs also show no signs of loosening of the external fixator pins. Treatment at this point should include:

1) Removal of external fixator and placement of a patellar tendon bearing (PTB) cast, and progression to weight bearing as tolerated
3) Removal of external fixation and intramedullary nailing
2) Irrigation and debridement
5) Placement of coralline hydroxyapatite into the fracture site
4) Autogenous bone grafting

In this patient, the soft tissue has healed from his open wound. The patient is progressing toward a delayed nonunion due to lack of callus formation. The next step should include autogenous bone grafting. The progression of his weight bearing status will lead to loosening of his external fixator pins.Correct Answer: Autogenous bone grafting

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3333. (2037) Q8-2453:

In the fixation of a diaphyseal closed tibia fracture with an intramedullary nail, peaks in intracompartmental pressures occur with:

1) Nail passage
3) Insertion of the awl at the starting point
2) Placement of distal locking screws
5) Placement of the proximal locking screw
4) Placement of the guide wire

Tornetta and associates showed that peaks in intracompartmental pressures occur in the fixation of a diaphyseal closed tibia fracture with an intramedullary nail during fracture reduction and nail passage. However, generally, these peaks are not sustained and return to baseline during unreamed nailing.Correct Answer: Nail passage

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3334. (2073) Q8-2494:

The primary treatment for anterior sternoclavicular dislocation is:

1) Open reduction internal fixation
3) Wiring to an adjacent rib
2) Closed reduction
5) Excision
4) Sling

Anterior sternoclavicular dislocations are benign injuries that do not affect any significant neurovascular structure. Attempts to reduce anterior sternoclavicular dislocations often result in high rates of redislocation; therefore, these dislocations are best left unreduced. Internal fixation has not been successful. Resection is recommended for chronic pain.Correct Answer: Sling

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3335. (2074) Q8-2495:

The primary treatment for acute posterior dislocation of the sternoclavicular joint is:

1) Closed reduction
3) Excision
2) Wiring to an adjacent rib
5) Sling
4) Open reduction internal fixation

Posterior dislocations of the sternoclavicular joint, unlike anterior dislocations, can be treated by a closed reduction. The tension forces of the clavicle will allow the sternoclavicular joint to generally remain anterior. The closed reduction is sometimes performed with a towel clip.Correct Answer: Closed reduction

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3336. (2075) Q8-2496:

The medial physis of the clavicle closes by age:

1) 18
3) 22
2) 20
5) 30
4) 25

The medial physis of the clavicle is the last to appear and the last to close. This is an important point because many injuries to the sternoclavicular area are actually physeal injuries, allowing bone-to-bone healing and, potentially, some remodeling.Correct Answer: 25

3337. (4049) Q8-2497:

Which of the following is not a design consideration in the titanium limited contact dynamic compression plate (LCDCP):

1) Uniform strength throughout the plate
3) The plates are slightly longer
2) Less stress shielding
5) Elongated holes
4) Increased vascularity to the cortex

Scallops under the plate allow increased cortical blood flow and elongated holes allow more variation in screw placement in titanium LCDCP design. Stress shielding is not a significant property of plates as was once thought.Correct Answer: Less stress shielding

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3338. (2076) Q8-2498:

The innervation of the brachialis muscle is:

1) Radial
3) Split between median and radial
2) Axillary
5) Split between radial and musculocutaneous
4) Musculocutaneous

The innervation of the brachialis is divide The lateral half of the brachialis is radially innervated and the medial half of the brachialis is innervated by the musculocutaneous nerve. This is an important point in approaches to the humerus because the muscles can be split to apply a plate.Correct Answer: Split between radial and musculocutaneous

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3339. (2077) Q8-2499:

Which of the following characteristics does not place the radial nerve at particular risk with distal humeral fractures:

1) Butterfly comminution
3) Transverse fracture
2) Lateral spike
5) Open
4) Varus

The classic Holstein-Lewis fracture is a distal-third fracture with a lateral spike displaced into varus. This allows the radial nerve to slip into the fracture site creating a palsy that can be worsened by closed reduction.Correct Answer: Butterfly comminution

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3340. (2078) Q8-2500:

Nonunions after antegrade locked nailing of the humeral shaft are best treated by:

1) Plate fixation
3) Exchange nailing
2) Bone grafting
5) Electrical stimulation
4) Plate fixation with bone grafting

Exchange nailing has not worked well in the humerus and reconstruction with plating without bone grafting has not been successful either. These nonunions tend to be atrophic and require significant rigidity and fresh autogenous cancellous grafting.Correct Answer: Plate fixation with bone grafting

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3341. (2079) Q8-2501:

Indications for internal fixation of the humeral shaft include all of the following except:

1) Acute radial nerve palsy
3) Bilateral humeral fractures
2) Ipsilateral forearm fracture
5) Polytrauma patient
4) Worsening radial nerve palsy

An acute radial nerve palsy is not an indication for internal fixation of the humeral shaft. The majority of patients with acute radial nerve palsies spontaneously recover. A worsening radial nerve palsy is an indication for exploration; and a floating elbow in a polytrauma patient is an indication for internal fixation of the humeral shaft, as well.Correct Answer: Acute radial nerve palsy

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3342. (2080) Q8-2502:

The primary goal of the Neer classification of proximal humeral fractures is to:

1) Determine the position of fragments
3) Delineate the number of fragments
2) Determine the best surgical approach
5) Determine whether the fracture has dislocated
4) Determine the vascularity of the articular segment

Neerâs four-part classification is designed to determine which fractures will result in avascular necrosis of the articular segment. In a four-part fracture, there is no residual blood supply to the articular segment.Correct Answer: Determine the vascularity of the articular segment

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3343. (2081) Q8-2503:

Implants protruding beyond the medial humeral neck can impinge on which of the following structures:

1) Axillary nerve
3) Radial nerve
2) Axillary vein
5) Musculocutaneous nerve
4) Axillary artery

With internal rotation, any implant protruding beyond the medial cortex of the humeral neck can impinge on the main trunk of the axillary nerve as it courses behind the humerus.Correct Answer: Axillary nerve

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3344. (2082) Q8-2505:

Which of the following structures is not at risk during a posterior approach of the shoulder:

1) Musculocutaneous nerve
3) Rotator cuff insertion
2) Suprascapular nerve
5) Deltoid muscle attachment
4) Axillary nerve

The axillary nerve and suprascapular nerve can be injured in the inferior and superior parts of the shoulder capsule. The deltoid attachment to the acromion can be damaged as well. These injuries can lead to disability. The musculocutaneous nerve is anterior and inferior and is an unlikely structure to be injured.Correct Answer: Musculocutaneous nerve

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3345. (2083) Q8-2506:

Which modality is best for diagnosing stress fractures:

1) Computed tomography scanning
3) Magnetic resonance imaging
2) Plain radiographs
5) Clinical evaluation
4) Technetium bone scanning

Magnetic resonance imaging shows immediate classic appearance of stress fractures. Computed tomography scanning shows bony architecture that may take time to develop. Bone scanning is too nonspecific; it shows activity but is not diagnosti Radiographs sometimes take 2 to 3 weeks to become positive.Correct Answer: Magnetic resonance imaging

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3346. (2084) Q8-2507:

Which of the following types of tibial fracture is most likely associated with compartment syndrome:

1) Closed
3) Grading of the fractures is irrevelant
2) Grade IIIA open
5) Grade IIIB open
4) Grade I or II open

A common fallacy is that the degree of open wound will prevent compartment syndrome by tearing the fascia. The amount of energy initially imparted to the tissues is the greatest determinant of a subsequent compartment syndrome.Correct Answer: Grade IIIB open

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3347. (2085) Q8-2508:

In a compartment syndrome, pressure measurements are:

1) Highest at the fracture site
3) Highest closer to the outer fascia
2) Diffuse throughout the muscle belly
5) Highest at ends of the fascia
4) Elevated in surrounding compartments also

The pressure is the highest at the fracture sit This is true even though this is a hydraulic effect of pressure. As the needle is inserted farther away from the fracture, the pressure drops.Correct Answer: Highest at the fracture site

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3348. (2086) Q8-2509:

When considering prophylatic antibiotics for low-velocity gunshot wounds:

1) Intravenous cephalasporin antibiotics are required
3) Oral ciprofloxacin for 3 days is adequate
2) Intravenous cephalasporin and gentemicin antibiotics are required
5) Intravenous gentamicin alone is necessary
4) Antibiotics have no role

Oral ciprofloxacin twice a day for 3 days provides equal prophylaxis to all of the mentioned regimens.Correct Answer: Oral ciprofloxacin for 3 days is adequate

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3349. (2087) Q8-2510:

Bullets must be removed if they are:

1) Intra-articular
3) In the peripheral muscles of the tibia
2) In the tissues of the thigh
5) Close to arteries
4) In the forearm muscles

Bullet fragments in the joint should be removed to prevent lead synovitis. If they are left in place, it could result in systemic lead toxicity.Correct Answer: Intra-articular

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3350. (2088) Q8-2511:

Most low velocity gunshot wounds to the humerus can be successfully treated with:

1) Open reduction internal fixation with plates and screws
3) Locked intramedullary nailing
2) Flexible intramedullary nailing
5) Hanging arm casts
4) Functional bracing

Low velocity gunshot wounds do not significantly destabilize the soft tissue envelope. Functional bracing is efficacious in the treatment of these conditions with a reported 2% nonunion rate.Correct Answer: Functional bracing

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3351. (2089) Q8-2512:

Isolated low velocity gunshot wounds to the femur are best managed by:

1) Immediate debridement and reamed locked intramedullary (IM) nailing
3) Plate fixation
2) Immediate skin edge debridement and early reamed locked IM nailing
5) External fixation followed by intramedullary nailing
4) Traction until the wound has healed followed by ream locked IM nailing

An isolated gunshot wound to the femur is not an immediate emergency. No significant increase in complications or infection results from waiting until the patientâs stomach is empty and a crew is available, provided the skin edges are debrided and a cephalosporin antibiotic is started.Correct Answer: Immediate skin edge debridement and early reamed locked IM nailing

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3352. (2090) Q8-2513:

Which of the following is true concerning the blood supply to the soleus muscle:

1) Arterial supply is entirely from the proximal muscle belly.
3) There are no major arteries entering the muscle, only collaterals.
2) Arterial supply is segmental.
5) There is only one artery supplying the muscle
4) The blood supply to the soleus muscle is inconsistent.

There is a major artery entering the upper portion of the soleus, but the artery can be ligated and the soleus rotated based on its distal pedicle.Correct Answer: Arterial supply is segmental.

3353. (2091) Q8-2514:

The incidence of osteonecrosis in three-part fractures of the proximal humerus is approximately:

1) 6%
3) 43%
2) 27%
5) 68%
4) 91%

Three-part fractures of the proximal humerus usually represent a fracture of the surgical neck and a fracture of the greater tuberosity. Treatment results of these fractures are related to the residual tuberosity displacement and the angulation of the head relative to the neck.

Osteonecrosis occurs in up to 27% of three-part fractures but is usually asymptomatic because it involves only a portion of the humeral head. Treatment, therefore, for these fractures should be based on the biomechanical aspects of the fracture rather than the vascularity of the humeral head.Correct Answer: 27%

3354. (2092) Q8-2515:

The incidence of radial nerve palsy in acute humeral shaft fractures in throwing athletes is approximately:

1) 1%
3) 16%
2) 6%
5) 56%
4) 36%

Ogawa and Yoshida analyzed 90 patients who sustained humeral shaft fractures while throwing to determine what caused their injuries. All patients were recreational baseball players, including 89 men and one woman. The average age was 25 years (range, 12 to 43 years). The throwing style, type of pitch, fielding position, and type of ball used varied; however, the patients sustained their fractures while performing a hard throw in 87 (97%) of the occurrences. The actual courses of the balls thrown ranged from sideways to straightforward. All fractures were external rotation spiral fractures; 25 patients (28%) had a medial butterfly fragment, and 14 patients (16%) had radial nerve palsy. Fractures were most likely to have occurred in the distal half of the humerus, although they occurred frequently in the proximal half in patients in their early teens.Correct Answer: 16%

3355. (2093) Q8-2516:

A 34-year-old man involved in a motor vehicle accident sustains a pneumothorax, a closed femur fracture, and closed, displaced fractures of the ipsilateral humerus, radius, and ulna. Management of his femur fracture is open reduction internal fixation. Management of his humerus fracture should consist of:

1) Skeletal traction
3) Open reduction and internal fixation of all fractures
2) Closed reduction and plaster immobilization
5) Internal fixation of the humeral fracture and immobilization of the forearm fracture
4) External fixation of all fractures

Indications for open reduction and internal fixation of humeral shaft fractures include open fractures, vascular injuries, floating elbow, polytrauma with multiple extremities, closed-head injury, and pathologic fractures.Correct Answer: Open reduction and internal fixation of all fractures

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3356. (2094) Q8-2517:

The incidence of fractures of the coronoid process in acute elbow dislocations is approximately:

1) 1%
3) 10%
2) 5%
5) 40%
4) 20%

Coronoid fractures are common and are associated with 10% of elbow dislocations and recurrent instability after dislocation. A review of 35 patients who had a fracture of the coronoid process of the ulna revealed three types of fracture: type I â avulsion of the tip of the process; type II â a fragment involving 50% of the process or less; and type III â a fragment involving more than 50% of the process. A concurrent dislocation or associated fracture was present in 14%, 56%, and 80% of these patients, respectively.

The outcome correlated well with the type of fracture. According to an objective elbow-performance index used to assess the results for the 32 patients who had at least 1 year of follow-up (mean, 50 months), 92% of the patients who had a type I fracture, 73% who had a type II fracture, and 20% who had a type III fracture satisfactory results. Residual stiffness of the joint was most often present in patients who had a type III fracture.Correct Answer: 10%

3357. (2095) Q8-2518:

After a fall, a 30-year-old man presents to the emergency department complaining of elbow pain. Examination in the emergency department reveals a two-part displaced radial head fracture with no comminution. The next step in management should include:

1) Open reduction internal fixation
3) Long arm cast
2) External fixation
5) Radial head excision
4) Examination with local anesthesia to assess elbow motion

Opinions are diverse regarding the approach to management of two-part displaced radial head fractures. This fracture pattern can vary in the amount of articular surface involved, the extent of impaction of the fracture fragment, the presence or absence of comminution in the radial neck, and the associated soft tissue involvement. It is of fundamental importance to assess the amount of forearm rotation and elbow flexion. When no block to motion exists and there is no palpable incongruity of the articular surface, conservative treatment with a splint provides a good result. If, however, a definable block to motion is demonstrated, operative intervention should be considered. At this point, the presence of associated soft tissue or skeletal trauma becomes an essential factor in the decision-making process. Examination under anesthesia, examination after intra-articular injection of local anesthetic, and stress radiographs are helpful in establishing the diagnosis.Correct Answer: Examination with local anesthesia to assess elbow motion

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3358. (2096) Q8-2519:

Which of the following motions is likely to be most affected after healing of a displaced greater tuberosity fracture:

1) Elevation
3) Extension
2) Abduction
5) External rotation
4) Internal rotation

Studies involving malunion of the greater tuberosity and malposition of the tuberosity from a varus surgical neck malunion indicate a need to evaluate these lesions more carefully. The limit of 1-cm displacement or 45Â° angulation may be too generous for classifying the lesion as nondisplaced, especially when the tuberosity assumes a position superior to the articular surface when the arm is resting at the side. On elevation, the normally small clearance in the subacromial space, if compromised, leads to impingement and tearing of the rotator cuff.Correct Answer: Elevation

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3359. (2097) Q8-2520:

For comminuted fractures of the radial head with more than three articular fragments (Mason type 3), the preferred treatment is:

1) Early range of motion
3) External fixation
2) Open reduction internal fixation
5) Total elbow arthroplasty
4) Excision of the radial head with or without prosthetic replacement

Ring and associates examined 56 patients with intra-articular fractures of the radial head who had been treated with open reduction and internal fixation. Patients were evaluated at an average of 48 months after injury. Thirty patients had a Mason type 2 (partial articular) fracture, and 26 patients had a Mason type 3 (complete articular) fracture. The result at the final evaluation was judged to be unsatisfactory when there was early failure of fixation or nonunion, a second operation was required to excise the radial head, less than 100Â° of forearm rotation was present, or the patient received a fair or poor rating according to the system of Broberg and Morrey.

Thirteen of the 14 patients with a Mason type 3 comminuted fracture with more than three articular fragments had an unsatisfactory result. Of the twelve patients with a type 3 fracture that split the radial head into two or three simple fragments, none had early failure, one had nonunion, and all had an arc of forearm rotation of greater than or equal to 100Â°. The data suggest that open reduction and internal fixation is best reserved for minimally comminuted fractures with three or fewer articular fragments. Comminuted fractures and fractures associated with complex elbow or forearm dislocation may be better treated by radial head excision with or without prosthetic replacement.Correct Answer: Excision of the radial head with or without prosthetic replacement

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3360. (2098) Q8-2521:

Which of the following mechanisms is the most common in cervical spine injuries in football players:

1) Rotation
3) Hyperextension
2) Hyperflexion
5) Distraction
4) Axial loading

The National Football Head and Neck Injury Registry has compiled epidemiologic, pathologic, biomechanical, and cinematographic data on head and neck injuries occurring in tackle football since 1971. Preliminary analysis performed in 1975 indicated that axial loading caused the majority of serious cervical spine football injuries.Correct Answer: Axial loading

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3361. (2099) Q8-2522:

Which of the following solutions is appropriate for the initial fluid management in a severely hypotensive trauma patient:

1) Saline, 1-L bolus
3) Saline, 1-L over a 1-hour period
2) Ringerâs lactate, 1-L bolus
5) Ringerâs lactate, 2-L bolus
4) Ringerâs lactate, 1-L over a 1-hour period

Infusion of a balanced salt solution such as Ringerâs lactate or saline should be started. Hypertonic saline solutions and colloid-containing solutions have also been used in trauma resuscitation protocols with varying degrees of success. The severely hypotensive trauma patient in hypovolemic shock should receive 2-L of a balanced salt solution as rapidly as possible.Correct Answer: Ringerâs lactate, 2-L bolus

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3362. (2100) Q8-2523:

The maximum amount of sagittal plane deformity that is acceptable for a fracture in the middle third of the proximal phalanx is:

1) 5Â°
3) 20Â°
2) 10Â°
5) 40Â°
4) 30Â°

Nondisplaced and minimally displaced fractures of the phalangeal shaft tend to be stable and can be statically immobilized or treated in dynamic fracture casts for 3 or 4 weeks. Fractures rarely displace more than that seen on the initial radiograph, however, they should be serially monitored for position, alignment, and healing. A guideline for acceptable reduction is no more than 10Â° of angulation in any plane of proximal and middle phalangeal shaft fractures and no clinical rotational malalignment.Correct Answer: 10Â°

3363. (2101) Q8-2524:

Which of the following is the most significant risk factor for the development of adult respiratory distress syndrome in the multiply injured patient with a femur fracture:

1) Chest injury
3) Head injury
2) Delay of 18 hours in stabilizing the fracture
5) Abdominal injury requiring laparotomy
4) Use of a reamed intramedullary rod for femoral fixation

A retrospective review of patients with multiple injuries with Injury Severity Scores of 18 points or higher who also had severe chest trauma was performed at the Erie County Medical Center in Buffalo, New York. Patients were divided into three groups. The patients in group 1 had femoral fractures that were treated with early stabilization with a reamed rod. The patients in group 2 had femoral fractures stabilized with plate fixation. In group 3, there were no femoral fractures. The Injury Severity Score for each group was nearly the same; however, the time in the intensive care unit for group 2 and group 3 was more than double that in group 1. There was a 33% adult respiratory distress syndrome rate in group 2, a 27% rate in group 3, and a 0% rate in group 1. The mortality rate was 10.9% in group 3 (patients without femoral fractures), which was the highest mortality rate among the three groups. These clinical data seem to associate a chest injury with increased rates of adult respiratory distress syndrome and mortality, as opposed to the method of treatment for the femoral fracture.Correct Answer: Chest injury

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3364. (2102) Q8-2525:

Which of the following tibial fractures is most likely to have residual angulation (more than 5Â°) after treatment with a statically locked intramedullary rod:

1) A distal third oblique fracture
3) A comminuted midshaft fracture
2) A proximal third metaphyseal fracture
5) An open transverse fracture with a large butterfly fragment
4) A transverse midshaft fracture

Fractures of the proximal third of the tibial shaft do not appear to respond as favorably to intramedullary nailing as do fractures in the distal two-thirds of the tibia. Valgus, apex anterior angulation, and residual displacement at the fracture site are common after nailing. Surgical errors of a medialized nail entry point and a posteriorly and laterally directed nail insertion angle contributed to malalignment. Based on their findings, the authors have limited the use of intramedullary nailing for proximal third tibial shaft fractures and consider alternate forms of fixation (plate or external fixation). An alternative technique is the use of blocking screws.Correct Answer: A proximal third metaphyseal fracture

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3365. (2103) Q8-2526:

Which of the following tibial plateau fractures is often associated with vascular injury:

1) Schatzker type I
3) Schatzker type III
2) Schatzker type II
5) Bilateral fractures
4) Schatzker type IV

A Schatzker type IV fracture is a fracture of the medial tibial plateau and may be a split or a split depression fracture. Many of these fractures represent a medial dislocation of the knee that has been reduced by the time the radiographs are taken. It is not the fracture of the medial plateau that gives this fracture its bad prognosis, but the associated injuries to the popliteal artery and peroneal nerve, as well as injuries to the collateral and cruciate ligaments. The arterial injury may be a rupture or only an intimal tear. Because of the frequence of associated popliteal artery injuries, whenever this lesion is recognized patients should be considered for an arteriogram to evaluate the artery and prevent and intraoperative or postoperative thrombosis.Correct Answer: Schatzker type IV

3366. (2104) Q8-2527:

The mortality rate associated with open pelvic fractures is approximately:

1) 10%
3) 30%
2) 20%
5) 75%
4) 50%

The mortality rate among 604 patients with pelvic fractures was 12%. Thirty-one percent had an open pelvic fracture, which is an injury associated with a 50% mortality rate. Twenty-three percent had pelvic fractureârelated iliac or femoral vessel disruptions, which are injuries associated with a 75% mortality rate. Mortality in these patients clearly resulted from ineffective control of pelvic hemorrhage and the inability to prevent sepsis in the pelvic hematoma.Correct Answer: 50%

3367. (2105) Q8-2528:

All of the following are indications for surgical management of humeral shaft fractures except:

1) Floating elbow
3) Varus angulation of 10Â°
2) Associated brachial plexus palsy
5) Polytrauma
4) Bilateral humeral fractures

Polytraumatized patients benefit from internal fixation of their humeral fracture to facilitate comfort, mobility, and nursing care. Bilateral humeral fractures constitute a specific injury complex in which humeral stabilization presents distinct advantages, allowing the patient earlier recovery of independence. Humeral fractures that are associated with both-bone forearm fractures, that is the "floating elbow" injury, require internal fixation to prevent nonunion and allow an earlier functional recovery of the entire limb. Patients with a brachial plexus palsy lose important muscular support of the fracture because of their motor dysfunction, which often results in distraction of the fracture fragments. Nonoperative treatment of such a fracture carries a high risk of nonunion, and internal fixation with a compression plate has been shown to improve results. The clinician should not accept more than 15Â° of varus angulation unless the patient is willing to accept visible deformity after union.Correct Answer: Varus angulation of 10Â°

3368. (2106) Q8-2529:

The incidence of complications and poor outcomes is high in fractures with vascular injury. Treatment for fractures with vascular injury should begin with which of the following steps:

1) Fracture alignment and stability
3) Recognition of compartment syndrome
2) Wound management
5) Early mobilization
4) Early (within 6 hours of injury) restoration of blood flow

The most important factor in treating fractures with a vascular injury is early restoration of blood flow. If provisional fracture stabilization precludes restoration of blood flow within this time frame, then arterial repair or placement of a temporary shunt should proceed first.Correct Answer: Early (within 6 hours of injury) restoration of blood flow

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3369. (2107) Q8-2530:

What percentage of patients sustaining ankle sprains have residual dysfunction at 6 months:

1) 10%
3) 40%
2) 20%
5) 80%
4) 60%

At the United States Military Academy, all cadets presenting with ankle injuries during a 2-month period were included in this prospective, observational study. The initial evaluation included an extensive questionnaire, physical examination, and radiographs. There were 104 ankle injuries accounting for 23% of all injuries seen. There were 96 sprains, 7 fractures, and 1 contusion.

At 6 months, all subjects had returned to full activity; however, 40% of cadets reported residual symptoms and 2.5% had a decrement of more than 20% on the lateral hop test. The factor most predictive of residual symptoms was a syndesmosis sprain, regardless of grade. Syndesmosis sprains were most prevalent in collision sports.

This study demonstrates that even though our knowledge and understanding of ankle sprains and rehabilitation of these injuries have progressed in the last 20 years, chronic ankle dysfunction continues to be a prevalent problem. The early return to sports occurs after almost every ankle sprain; however, dysfunction persists in 40% of patients for as long as 6 months after injury. Syndesmosis sprains are more common than previously thought, and this confirms that syndesmosis sprains are associated with prolonged disability.Correct Answer: 40%

3370. (2108) Q8-2531:

In what percentage of ankle fractures does arthroscopically proven articular cartilage damage to the talus occur:

1) 10%
3) 50%
2) 20%
5) 100%
4) 70%

We have prospectively evaluated the arthroscopic findings in acute fractures of the ankle in 288 consecutive patients (148 men and 140 women) with a mean age of 45.6 years. According to the AO Danis-Weber classification, there were 14 type A fractures, 198 type B, and 76 type C. Lesions of the cartilage were found in 228 ankles (79.2%). These lesions were more often on the talus (69.4%) than on the distal tibia (45.8%), the fibula (45.1%), or the medial malleolus (41.3%).Correct Answer: 70%

3371. (2109) Q8-2532:

The most common thoracic injury after blunt trauma is:

1) Rib fracture
3) Myocardial contusion
2) Aortic rupture
5) Pneumothorax
4) Pulmonary contusion

Thoracic trauma occurs in 50% to 75% of all fatalities caused by blunt trauma. However, only 15% of thoracic injuries require surgical intervention. After head injuries, thoracic injuries are the second leading cause of death in trauma patients. Rib fractures are the most common (40%) thoracic injury in blunt trauma. Associated injuries (such as aortic arch rupture) should be suspected with high rib fractures. Liver and spleen injuries are common with low rib injuries. Pulmonary and cardiac contusion should be suspected in multiple rib injures.Correct Answer: Rib fracture

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3372. (2110) Q8-2533:

Immediate stabilization of femur fractures within the first 24 hours in polytrauma patients decreases the risk of which of the following:

1) Infection
3) Heterotopic ossification
2) Nonunion
5) Pulmonary complications
4) Shortening

The patients were divided into two groups: patients who had an isolated fracture of the femur and those who had multiple injuries. When stabilization of the fracture was delayed in the patients who had multiple injuries, the incidence of pulmonary complications (adult respiratory distress syndrome, fat embolism, and pneumonia) was higher, the hospital stay was longer, and the number of days in the intensive care unit was increased.Correct Answer: Pulmonary complications

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3373. (2111) Q8-2534:

The risk for avascular necrosis of the hip following stabilization of femur fractures with ipsilateral femoral neck and shaft fractures is:

1) 40%
3) Less than 5%
2) 60%
5) 25%
4) 10%

A midshaft femoral fracture in a high-energy trauma victim should prompt the orthopedist to search carefully for an ipsilateral fracture of the femoral neck. This fracture is present in 5% of patients, and the incidence may be increasing. Management of the femoral neck fracture should include anatomic reduction and screw fixation with compression. The use of capsulotomy remains controversial. Management of the femoral shaft should not interfere with these goals because of the risk of post-traumatic necrosis of the femoral head. The risk of avascular necrosis after stabilization of ipsilateral femoral neck and shaft fractures is less than 5%. Successful methods of management of the femoral shaft fracture have included compression plating, retrograde Kuntscher nailing, and interlocking nails. Approaches to the treatment of concomitant intertrochanteric and femoral shaft fractures should be selected according to the skill and experience of the surgeon and the availability of equipment.Correct Answer: Less than 5%

3374. (2112) Q8-2535:

The percentage of missed femoral neck fractures in fractures with an ipsilateral femoral neck and shaft fractures is approximately:

1) Less than 5%
3) 35%
2) 20%
5) 75%
4) 50%

Ipsilateral fractures of the femoral neck and shaft present diagnostic difficulties and complex choices with regard to treatment. A review of the 83 cases reported in the literature revealed that approximately one-third of the fractures of the femoral neck were missed initially.Correct Answer: 35%

3375. (2113) Q8-2536:

Posterior shoulder dislocations are most often associated with which of the following fractures:

1) Lesser tuberosity
3) Greater tuberosity
2) Clavicle
5) Surgical neck
4) Scapular neck

When isolated two-part lesser tuberosity fractures occur, a posterior dislocation should be taken for granted until accurate imaging studies can disprove it. An axillary lateral view radiograph or computed tomography scan will establish the diagnosis.Correct Answer: Lesser tuberosity

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3376. (2114) Q8-2537:

Which of the following fractures occur in up to one-third of anterior shoulder dislocations and is the most common isolated fracture occurring in skierâs:

1) Lesser tuberosity fractures
3) Clavicle fractures
2) Scapular neck fractures
5) Surgical neck fractures
4) Greater tuberosity fractures

Two-part greater tuberosity fractures comprise 14% of displaced proximal humeral fractures with or without anterior dislocation and are the most common isolated fractures occurring in skiers. Anatomically, there are separate facets for the supraspinatus, infraspinatus, and teres minor insertions. Significant displacement of any or all of these facets is pathognomonic of a longitudinal tear of the rotator cuff. The indications for treatment include displacement greater than 5 mm. Greater tuberosity fractures may occur in up to one-third of anterior shoulder dislocations. The glenohumeral joint frequently reduces spontaneously before emergency treatment and radiographic documentation.Correct Answer: Greater tuberosity fractures

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3377. (2115) Q8-2538:

The method of stabilization of open tibial fractures should be based primarily on:

1) Age of the patient
3) Soft tissue injury
2) Fracture pattern
5) Severity of other musculoskeletal injuries
4) Amount of bone loss

As classification systems have become more focused in differentiating severe tibia fractures, it has become apparent that soft tissue damage, including periosteal stripping and tissue loss, is the primary determinant of infection and nonunion. Meticulous wound care is the cornerstone of successful management of all open fractures of the tibial shaft, regardless of the implant used for tibial fixation.Correct Answer: Soft tissue injury

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3378. (2116) Q8-2539:

The safest distance below the knee for placement of external fixation wires is:

1) 5 mm
3) 14 mm
2) 9 mm
5) 25 mm
4) 19 mm

The joint capsule reflects 14 mm below the joint line. Pins placed less than 14 mm below the knee are at risk for articular penetration. Violation of the proximal tibio-fibular joint can also lead to knee sepsis.Correct Answer: 14 mm

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3379. (4050) Q8-2540:

When comparing retrograde femoral nailing to antegrade femoral nailing, which of the following statements is true:

1) Both femoral nailing techniques have similar rates of union.
3) Antegrade femoral nailing has a higher rate of union.
2) Retrograde femoral nailing has a higher rate of malunion.
5) Antegrade femoral nailing is always superior.
4) Retrograde femoral nailing is always superior.

When considering the entire length of the femur with similar reaming techniques, there are no differences in union rates, malunion rates, or times to union.Correct Answer: Both femoral nailing techniques have similar rates of union.

3380. (2117) Q8-2541:

The greatest difference between antegrade femoral nailing and retrograde femoral nailing is:

1) Infection rate
3) Hip versus knee pain
2) Distal alignment
5) Union rates
4) Iatrogenic fractures

The entry portal damage determines the difference between antegrade femoral nailing and retrograde femoral nailing. Antegrade femoral nailing damages the hip, whereas retrograde femoral nailing damages the knee. The relative severity of damage has not been determined.Correct Answer: Hip versus knee pain

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3381. (2118) Q8-2542:

When comparing reamed femoral nails to nonreamed femoral nails:

1) Reamed femoral nails unite faster than nonreamed femoral nails.
3) There is no difference in union time between reamed femoral nails and nonreamed femoral nails.
2) Nonreamed femoral nails unite faster than reamed femoral nails.
5) Nonreamed nails protect the lungs.
4) The rate of nonunion is higher in patients with nonreamed femoral nails.

When comparing patients with reamed femoral nails to patients with nonreamed femoral nails, both groups of patients will reliably unite but reamed femoral nails unite faster â 80 days versus 109 days.Correct Answer: Reamed femoral nails unite faster than nonreamed femoral nails.

3382. (2119) Q8-2543:

When using nonreamed tibial nails in blunt polytrauma patients, the delayed and nonunion rates are:

1) 15%
3) 39%
2) 27%
5) 60%
4) 51%

In a study by Riemer and colleagues, a reoperation rate of 39% to achieve union was reported. Therefore, some authors have advocated routine dynamization.Correct Answer: 39%

3383. (2120) Q8-2544:

When comparing titanium nonreamed tibial nails to stainless steel nonreamed tibial nails:

1) There is no clinical difference between titanium nonreamed tibial nails and stainless steel nonreamed tibial nails.
3) Titanium nonreamed tibial nails frequently fail due to notching from locking screws.
2) Titanium nonreamed tibial nails unite faster than stainless steel nonreamed tibial nails.
5) The nail determines union rates.
4) Stainless steel nonreamed tibial nails and locking screws fail from fatigue more frequently.

The high failure rate (25%) of stainless steel nonreamed tibial nails is due to fatigue. Titanium nonreamed tibial nails have a lower failure rate (2%) as a result of fatigue.Correct Answer: Stainless steel nonreamed tibial nails and locking screws fail from fatigue more frequently.

3384. (2121) Q8-2545:

When inserting nonreamed nails in an acute tibial diaphyseal fracture, the most important prognostic factor that predicts union is:

1) Grading of open fractures
3) Longitudinal localization
2) Classification of comminution
5) Patient age
4) Locking mode

The locking mode used in the tibial diaphysis (unlike the femur) has a dramatic effect on union rate and time.Correct Answer: Locking mode

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3385. (2122) Q8-2546:

Anterior articular marginal fractures of the distal radius are:

1) Best managed by compression plating
3) Usually treated by buttress plating
2) Usually amenable to closed reduction
5) Well managed by percutaneous pins
4) Well managed by external fixation

An anterior articular marginal fracture of the distal radius requires buttress plating. Adequate fixation may be attained without screws in the distal fragment. Closed reductions are rarely successful. Locked plating is inadequate.Correct Answer: Usually treated by buttress plating

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3386. (2123) Q8-2547:

Which of the following statements regarding muscle pedicle grafts for acute femoral neck fractures is true:

1) The infection rate is 20%.
3) Positioning of muscle pedicle grafts for acute femoral neck fractures is difficult.
2) Operating room time is excessive.
5) Some complications rates may result from fixation in the lateral position on a fracture table.
4) The incidence of hardware failure is identical when using muscle pedicle grafts.

The use of muscle pedicle grafts for acute femoral neck fractures is associated with high complication rates, totaling 68% (implant failure rate of 48%, an infection rate of 20%, and excessive operating room time). Some of the complication rates may result from fixation in the prone position on a fracture table.Correct Answer: Operating room time is excessive.

3387. (2124) Q8-2548:

Fibular fixation in comminuted pilon fractures:

1) Is always necessary
3) Is safe and reliable
2) Is best accomplished with intramedullary fixation
5) Should never be a consideration
4) Is associated with a high complication rate with questionable benefit when spanning the joint with a unilateral hinged fixator

Adequate ligamentotaxis allows acceptable results. Fixation is associated with a high complication rate including infection, nonunion, and malunion.Correct Answer: Is associated with a high complication rate with questionable benefit when spanning the joint with a unilateral hinged fixator

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3388. (2125) Q8-2549:

Reudi & Allgrower have shown that plate and screw ORIF for pilon gives excellent results if all of the follwing are followed except:

1) Anatomic reconsturction of the joint obtained
3) Bond graft
2) Good rigid internal fixation
5) Non weight bearing for 3 months
4) External fixation

Reviewing the radiographs of this period it was clear that insufficient reconstruction of the joint was obtained and this, in addition to less rigid fixation and the absence of a bone-graft, may have been responsible for the poor results. In addition to the importance of good reconstruction of the ankle-joint we would like to stress the importance of relieving the leg of weight-bearing for a minimum period of 3 months after operation but to combine this with active movement.Correct Answer: External fixation

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3389. (2126) Q8-2550:

In an animal model, femoral intramedullary nail fixation in the presence of a pulmonary injury and adequate resuscitation:

1) Has a negative effect on pulmonary function
3) Has no effect on pulmonary function
2) Has a delayed effect on pulmonary function
5) Is not associated with dissemination of intravascular fat
4) Is associated with a disseminated intravascular-type state

With adequate resuscitation, reaming the femur does not jeopardize pulmonary function although increased fat and intraluminal pressures are present.Correct Answer: Has no effect on pulmonary function

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3390. (2127) Q8-2551:

When using small wire fixators for periarticular fractures the incidence of septic arthritis is approximately:

1) 2%
3) 15%
2) 10%
5) 30%
4) 25%

A higher incidence of septic arthritis is found in plateau fractures compared to pilon fractures, but the overall rate for septic arthritis is approximately 2%.Correct Answer: 2%

3391. (2128) Q8-2552:

Reamed retrograde femoral nailing:

1) Increases the vascularity of the anterior cruciate ligament
3) Has no effect on the vascularity of the knee ligaments
2) Decreases the vascularity of the posterior cruciate ligament
5) Alters the flow of blood to the entire leg
4) Increases the vascularity of the posterior cruciate ligament

Reamed retrograde nailing of the femur through the knee significantly decreases the blood flow through both cruciate ligaments by approximately 50%. The clinical significance of this finding is unclear.Correct Answer: Decreases the vascularity of the posterior cruciate ligament

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3392. (2129) Q8-2553:

Which of the following is a contraindication to reamed nailing for tibial nonunions:

1) Previous sepsis
3) Angular deformity
2) Translational deformity
5) Fibrous union
4) Rotational deformity

The relative contraindications to reamed nailing for tibial nonunions are shortening and previous sepsis. Most other deformities can be corrected and nailed.Correct Answer: Previous sepsis

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3393. (2130) Q8-2554:

Disadvantages of Hackethal retrograde humeral nailing include:

1) Shoulder stiffness
3) Elbow stiffness
2) Painful hardware
5) Nonunion
4) Infection

Most patients treated with Hackethal retrograde humeral nailing for humeral shaft fractures require a second procedure for implant removal. Elbow stiffness and irritation are transient.Correct Answer: Painful hardware

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3394. (2131) Q8-2555:

Which of the following statements is false when comparing plating to Hackethal retrograde nailing for humeral diaphyseal fractures:

1) Similar rates of joint function are achieved with both techniques.
3) Hackethal nails have a higher union rate than plating.
2) Nails require removal, not plates.
5) Nails require the support of a brace.
4) Similar union rates are achieved with both techniques.

Other than the need for metal removal and the support of a brace, Hackethal nailing and plating produce similar results.Correct Answer: Hackethal nails have a higher union rate than plating.

3395. (2132) Q8-2556:

In tibial shaft fractures with an arterial injury below the popliteal artery:

1) One patent artery is not always adequate for limb survival.
3) Bony injury does not correlate with poor clinical results.
2) Delay to revascularization and degree of soft tissue injury correlate with amputation rates.
5) Intramedullary nailing is mandatory.
4) Amputation is inevitable due to the size of the vessels.

In patients with an arterial injury below the popliteal artery, the period of avascularity and the soft tissue injury determine the amputation rate. Among those patients who keep their limbs, the bony injury correlates with function.Correct Answer: Delay to revascularization and degree of soft tissue injury correlate with amputation rates.

3396. (2133) Q8-2557:

What factor most accurately determines functional outcomes after adequately reducing closed low-energy fractures of the tibial plateau:

1) Fracture classification
3) Age
2) Further reduction of the fracture
5) Activity level
4) Mechanism of injury

After an adequate reduction is attained in relatively low-energy plateau fractures, age determines functional outcome. According to a study by Stevens and colleagues, 40 years of age is the reported cut-off for determining functional outcome. This study points out the importance of age in prognosis.Correct Answer: Age

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3397. (2134) Q8-2558:

Nonreamed intramedullary nailing of the tibia is superior to external fixation in all parameters except:

1) Union rates
3) Surgical site infection rates
2) Traumatic site infection rates
5) Reoperation rates
4) Rates of malalignment

External fixation and nonreamed intramedullary nailing are associated with equivalent rates of union.Correct Answer: Union rates

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3398. (2135) Q8-2559:

When comparing antegrade nailing to plating of the humerus, which of the following statements is false:

1) Identical union rates are achieved with both antegrade nailing and plating of the humerus.
3) Plating of the humerus is associated with more elbow complications than antegrade nailing.
2) Antegrade nailing is associated with more shoulder complications than plating of the humerus.
5) Higher union rates result with plating of the humerus.
4) Identical rates of neurologic injuries are seen.

Chapman and associates demonstrated that antegrade nailing and plating of the humerus were the same, trading shoulder for elbow complications. Nailing was also associated with a higher rate of metal removals.Correct Answer: Higher union rates result with plating of the humerus.

3399. (2136) Q8-2560:

The most important factor in predicting cutout of an implant to repair intertrochanteric fractures of the hip is:

1) Size of the chosen screw
3) Tip/apex distance
2) Posterior/inferior placement
5) Angle of the plate
4) Pitch of the chosen screw

The most important factor in predicting cutout of an implant is the tip/apex distance. Screw design is a consideration but is limited by the anatomy of the proximal femur. Posterior/inferior placement was a factor used with old devices that did not purchase adequately in the femoral head.Correct Answer: Tip/apex distance

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3400. (2137) Q8-2562:

Which treatment should be avoided when repairing a tibial nonunion after external fixation:

1) Nonreamed nailing
3) Reamed nailing
2) Bone grafting
5) Plating
4) Electrical stimulation

Reamed nailing after tibial external fixation is associated with a high level of infection and persistent nonunion. Nonreamed nailing has proven far more efficacious. Electrical stimulation and bone grafting may also be used. Plating has been shown to be efficacious in certain circumstances.Correct Answer: Reamed nailing

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3401. (2138) Q8-2563:

Neurologic function in compartment syndromes:

1) Deteriorates early
3) Is rarely compromised
2) Is necessary to diagnose a compartment syndrome
5) Is determined by the vascularity of the nerves within the specific compartment
4) Always deteriorates

Compartment syndromes involve the muscles in a compartment. Pressure can inconsistently effect nerves. Some compartments have no major nerves and are never associated with neurologic symptoms.Correct Answer: Is determined by the vascularity of the nerves within the specific compartment

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3402. (2139) Q8-2564:

Reamed humeral nailing is associated with high rates of:

1) Iatrogenic comminution
3) Infection
2) Persistent nonunion after exchange
5) Reaming the humerus is irrelevant.
4) Nonunion

Reaming of the humerus should be avoided because the canal is tight and tapers distally. The bone is hard and cannot be reliably cut without excessive heat generation.Correct Answer: Reaming the humerus is irrelevant.

3403. (2140) Q8-2565:

The incidence of femoral shaft fractures that have an associated femoral neck fracture is approximately:

1) 1%
3) 6%
2) 3%
5) 15%
4) 10%

Approximately 6% of femoral shaft fractures caused from blunt trauma have an associated femoral neck fracture.Correct Answer: 6%

3404. (2141) Q8-2566:

The cause of femoral neck fractures above an ipsilateral femoral shaft fracture, discovered during antegrade nailing, is:

1) An entry portal too medial during antegrade nailing
3) An entry portal too anterior during antegrade nailing
2) Unrelated to the antegrade nailing technique
5) Usually related to a technical error
4) Excessive force when inserting a nail

The late discovery of femoral neck fracture is unrelated to the antegrade nailing technique. Similar complications are reported with femoral plating when the neck is not instrumented. These complications always relate to the original trauma.Correct Answer: Unrelated to the antegrade nailing technique

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3405. (2142) Q8-2567:

When comparing reamed and nonreamed nailing to reconstruct the tibial diaphysis after external fixation, which of the following statements is true:

1) Reamed nails heal faster than nonreamed nails.
3) There is no difference between reamed and nonreamed nailing to reconstruct the tibial diaphysis after external fixation.
2) Previous pin tract infections are irrelevant.
5) Nonreamed nails are capable of stimulating union more reliably than reamed nails.
4) Reamed nails tend to become infected less frequently than nonreamed nails.

When comparing reamed and nonreamed nails, nonreamed nails consistently perform better in areas of union, infection rates, and times to union. Previous pin tract infection predisposes to late infections, primarily following reamed nailing.Correct Answer: Nonreamed nails are capable of stimulating union more reliably than reamed nails.

3406. (2143) Q8-2568:

When inserted into intertrochanteric fractures, intramedullary hip screw devices are not associated with:

1) Iatrogenic fractures of the greater trochanter and lateral cortex
3) Maintenance of the shape of the upper femur in comminuted fractures
2) An improved ability to ambulate when compared to a compression hip screw
5) Less sliding
4) Increased sliding

Intramedullary hip screw devices do not slide as much as compression hip screws. Intramedullary hip screw devices help maintain the shape of the upper femur and less shortening and malrotation are present.Correct Answer: Increased sliding

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3407. (2144) Q8-2569:

Which of the following complications is increased when intramedullary hip screws are used for intertrochanteric fractures:

1) Excessive sliding
3) Periprosthetic fractures
2) Excessive shortening
5) Increased cutout
4) Increased blood loss

Several authors have reported an increase in fractures of the femur around the distal end of an intramedullary hip screw device. Some of the fractures were due to excessively bent, ill-fitting nails; however, most fractures relate to improper locking technique. Some compression hip screw devices are also associated with periprosthetic fractures.Correct Answer: Periprosthetic fractures

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3408. (2145) Q8-2571:

When plating fractures of the femoral diaphysis, the plate should be applied to which surface of the femur:

1) Anterolateral
3) Posterolateral
2) Lateral
5) Anterior
4) Medial

When using indirect reduction techniques to plate the femoral diaphysis, the vastus lateralis should be elevated from the linea aspera. This exposes the posterolateral surface of the femur, which is flat and accommodates a plate well. There is minimal stripping of the blood supply with this technique.Correct Answer: Posterolateral

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3409. (2146) Q8-2572:

When comparing compression hip screw to multiple cancellous screw fixation of femoral neck fractures:

1) There is no difference between compression hip screw and multiple cancellous screw fixation.
3) The nonunion rate associated with the compression hip screws is greater than the nonunion rate associated with multiple cancellous screws.
2) The compression hip screw is associated with superior results.
5) Only one cannulated screw is needed.
4) There is no difference in the vascularity of the femoral head following a procedure with either compression hip screws or multiple cancellous screws.

In prospective studies comparing multiple screws to the compression hip screw, the bulk of the compression hip screw and the additional torque applied created an increased rate of avascularity and nonunion when compared to parallel cancellous screw fixation.Correct Answer: The nonunion rate associated with the compression hip screws is greater than the nonunion rate associated with multiple cancellous screws.

3410. (2147) Q8-2573:

When performing cemented hemiarthroplasty for a displaced femoral neck fracture, polymethylmethacrylate (PMMA) should:

1) Always be used
3) Be substituted in an attempt to insert a press-fit prosthesis
2) Never be used
5) Not affect cardiopulmonary function
4) Be avoided in patients with cardiopulmonary disease

Generally, most hemiarthroplasties should be cemented to prevent the complications of osteoporotic bone fracturing, especially if the femur has bowed. The greatest contraindication to PMMA is the presence of severe cardiopulmonary disease because this can cause serious systemic complications.Correct Answer: Be avoided in patients with cardiopulmonary disease

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3411. (2148) Q8-2574:

When comparing unipolar hemiarthroplasty to bipolar hemiarthroplasty for displaced femoral neck fractures:

1) There is increased wear with unipolar hemiarthroplasty.
3) Bipolar hemiarthroplasties are superior.
2) A dislocated bipolar hemiarthroplasty is difficult to reduce.
5) Better function is obtained with a bipolar hemiarthroplasty.
4) A bipolar hemiarthroplasty will outlast a unipolar hemiarthroplasty because of metal/polyethylene movement.

There is no difference in function between a unipolar or bipolar hemiarthroplasty. The disadvantages of the bipolar hemiarthroplasty include a substantial increase in cost and dislocations are difficult to reduce closed. A special circumstance is needed to justify the cost of a bipolar hemiarthroplasty.Correct Answer: A dislocated bipolar hemiarthroplasty is difficult to reduce.

3412. (2149) Q8-2575:

The primary blood flow to the femoral head comes from the:

1) Terminal branches of the medial femoral circumflex artery
3) Femoral artery
2) Ligamentum teres
5) Lateral femoral circumflex artery
4) Synovial vessels

The medial femoral circumflex artery provides the main blood supply to the femoral head. Trueta performed injection studies and documented that the terminal branches of the medial femoral circumflex artery provide more blood supply than any other source. The ligamentum teres provides segmental blood flow only to a portion of the femoral head.Correct Answer: Terminal branches of the medial femoral circumflex artery

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3413. (2150) Q8-2576:

When is nonoperative treatment of nondisplaced femoral neck fractures indicated:

1) In all geriatric cases
3) In all cases
2) In all cases when osteopenia is present
5) Never indicated
4) Only when a serious contraindication to surgery exists

The primary treatment for nondisplaced femoral neck fractures is prophylactic open reduction internal fixation. The rate of displacement and disimpaction is significant, ranging from 15% to 30%. Complications relating to internal fixation are often less than 10%.Correct Answer: Only when a serious contraindication to surgery exists

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3414. (2151) Q8-2577:

The best predictor of fracture union after a displaced femoral neck fracture is:

1) Quality of the bone
3) Weight bearing
2) Angle of the screws
5) Age of the patient
4) Adequacy of reduction

Adequacy of reduction has been shown in several studies to be the best predictor of ultimate outcome. It is not clear whether this is based on technique or the nature of the original fracture. If a fracture is more difficult to reduce, it is generally more comminuted and has sustained a higher level of trauma.Correct Answer: Adequacy of reduction

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3415. (2152) Q8-2578:

The optimal number of screws to repair displaced fractures of the femoral neck is:

1) Three
3) Two
2) Five
5) Six
4) Four

Studies show that the optimal treatment for displaced fractures of the femoral neck is three parallel screws in a tripod configuration. Adding a fourth or fifth screw does not improve fixation, adds to technical difficulties, and theoretically, more vascular damage to femoral head can occur.Correct Answer: Three

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3416. (2153) Q8-2579:

The proper prescription for weight bearing after internal fixation of hip fractures in geriatric patients should be:

1) Nonweight bearing
3) Crutches until union
2) Weight bearing as tolerated
5) Cane ambulation
4) Touch down gait

The forces acting on the hip when getting in and out of bed or on and off a commode are greater than those associated with normal ambulation. In most circumstances, a patient will apply less force to the hip when weight bearing as tolerated.Correct Answer: Weight bearing as tolerated

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3417. (2154) Q8-2580:

When treating comminuted intertrochanteric fractures, a medial displacement osteotomy does not:

1) Place the femoral neck in valgus
3) Displace the femoral shaft medially
2) Decrease the forces on the inplant
5) Maintain normal hip anatomy
4) Create a permanent lurch

Medial displacement osteotomy was used prior to the routine use of the compression hip screw. To avoid cutout, a permanent lurch was accepted. The osteotomy involved medial displacement of the shaft of the femur and valgus deformity of the head and neck fragment.Correct Answer: Maintain normal hip anatomy

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3418. (2155) Q8-2581:

The most sensitive modality for the diagnosis of occult fractures of the femoral neck is:

1) Oblique radiograph
3) Tomography
2) Computed tomography scanning
5) Radionucleide scanning
4) Magnetic resonance image scanning

In numerous studies, the magnetic resonance image scan has proven superior to all other modalities for the diagnosis of occult fractures of the femoral neck. In addition, it is virtually immediately positive and can be performed in an outpatient setting.Correct Answer: Magnetic resonance image scanning

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3419. (2156) Q8-2582:

When an arterial injury is associated with a femoral diaphyseal fracture:

1) Immediate exploration of the fracture site should be performed.
3) A wide-field angiogram should be obtained to examine for lesions away from the fracture site.
2) Fluoroscopy is a safe technique to use for an angiographic procedure.
5) Fracture fixation should be performed prior to angiography.
4) Angiography is always indicated before vascular exploration.

Arterial injuries sometimes occur away from a fracture site. Primary exploration is not indicated unless a prolonged ischemic time mandates immediate surgery. When possible, a wide-field angiogram should be performed to visualize all associated arterial injuries.Correct Answer: A wide-field angiogram should be obtained to examine for lesions away from the fracture site.

3420. (2157) Q8-2583:

The optimal wire position for fixation of patella fractures is:

1) Anterior surface of the patella
3) Interosseous wires
2) Circumferentially around the patella (cerclage wires)
5) Wires are not needed.
4) The positioning of the wire makes no difference.

The anterior surface of the patella is the tension surface. Control of the tension surface allows compression on the inner surface, causing the bone to absorb stress and relieve the wire of the need to support movement. This is the tension band principle.Correct Answer: Anterior surface of the patella

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3421. (2158) Q8-2584:

Which of the following prognostic criteria is not associated with fractures of the tibial plateau:

1) Articular congruency
3) Widening of the tibial plateau
2) Stability with the knee in extension
5) Gender
4) Age of the patient

Articular congruency, stability with the knee in extension, and widening of the tibial plateau are important prognostic criteria. Stability with the knee in extension is an expression of not only the potential for ligamentous instability but also deformity. Widening of a tibial plateau takes the weight-bearing surface of the tibia out from under the femur and is associated with the femur articulating an area of bone without articular cartilage.Correct Answer: Gender

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3422. (2159) Q8-2585:

Angiography should be used in dislocations of the knee:

1) In the presence of asymmetric pulses
3) With absent pulses only
2) In all cases
5) Has been replaced by magnetic resonance image scanning
4) Does not need to be used as long as Doppler pulses are audible

Some controversy exists as to the role of angiography. It is clear that if pulses are not symmetric, angiography is indicated. By the time a Doppler study is needed, pulses are not palpable and angiography should be performed anyway. The need for angiography should not be determined by absent pulses, only asymmetric pulses.Correct Answer: In the presence of asymmetric pulses

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3423. (2160) Q8-2586:

Most low-energy, minimally displaced tibia fractures are optimally treated with:

1) Fracture bracing
3) Nonreamed intramedullary nailing
2) Reamed intramedullary nailing
5) Short leg casting
4) Long leg casting

Fracture bracing is the classic treatment for low-energy, isolated fractures of the tibial diaphysis when a reduction can be maintained. Rapid union can be expected. Controversy exists when a reduction is necessary.Correct Answer: Fracture bracing

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3424. (2161) Q8-2587:

When controlling for the amount of initial displacement and soft tissue injury, the longitudinal area of the tibia that is most likely to be associated with a nonunion is:

1) Proximal metaphysis
3) Tibial shaft
2) Junction of the proximal metaphysis and diaphysis
5) Supramalleolar area
4) Junction of diaphysis and distal third

The most likely area for a tibial nonunion is the junction of the proximal diaphysis and metaphysis. When controlling for the amount of soft tissue injury, more nonunions are likely to occur in the proximal tibia because more high energy fractures occur distally.Correct Answer: Junction of the proximal metaphysis and diaphysis

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3425. (2162) Q8-2588:

Which mechanism of injury is most likely associated with severe soft tissue damage from a fracture of the tibia:

1) Direct blow
3) Motor vehicle accident
2) Motorcycle accident
5) Low velocity gunshot
4) Sports injury

Direct blow fractures, particularly from a baseball bat, are far more likely to be associated with a compartment syndrome than any other mechanism. In a series by Levy and Bromberg, the incidence of compartment syndromes caused by a direct blow was approximately nine times that of other mechanisms.Correct Answer: Direct blow

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3426. (2955) Q8-3461:

Patients with neglected brachial plexus injuries may achieve good functional results after shoulder joint arthrodesis if:

1) The function of the deltoideus muscle is preserved.
3) The function of the serratus anterior muscle is preserved.
2) The function of the pectoralis major muscle is preserved.
5) Achieving good functional results after shoulder joint arthrodesis does not depend on preserved function of shoulder girdle muscles.
4) The function of the latissimus dorsi muscle is preserved.

The serratus anterior muscle is the main stabilizing and motor muscle of the scapula in the anterolateral plane, which is innervated by the nervus thoracicus longus (C_5-C_7). Thus, a patient who has shoulder joint arthrodesis after a neglected brachial plexus injury has an optimal level of shoulder abduction only if function of the serratus anterior muscle is preserved.Correct Answer: The function of the serratus anterior muscle is preserved.

3427. (2956) Q8-3462:

Which of the following muscles in case of its transposition has the maximum renewal of power and amplitude of elbow flexion in patients with a brachial plexus injury:

1) Latissimus dorsi muscle
3) Pectoralis major muscle
2) Sternocleidomastoideus muscle
5) Trapezius muscle
4) Triceps muscle

The latissimus dorsi muscle has a greater renewal of power and amplitude of elbow flexion than the sternocleidomastoideus muscle, the pectoralis major muscle, the triceps muscle, and the trapeziuis muscle.Correct Answer: Latissimus dorsi muscle

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3428. (2957) Q8-3463:

A patient has an absence of function renewal resulting from a brachial plexus injury. In which of the following ways should nerve reconstructive orthopedic surgery be performed:

1) In normal physiological terms of reinnervation for every upper extremity muscle group
3) 3 times as long as normal physiological terms of reinnervation for every upper extremity muscle group
2) 1.5-2 times as long as normal physiological terms of reinnervation for every upper extremity muscle group
5) 6 months after the brachial plexus injury
4) 1 year after the brachial plexus injury

The normal speed of nerve regeneration is 1 mm per day. Nerve regeneration may be slower in patients with complications. Surgeons should not perform reconstructive orthopedic surgery until double physiological terms of nerve regeneration are over. However, surgeons should not wait longer than the double physiological term of reinnervation to perform surgery because deinnervated muscle atrophy prevents effective functional renewal after surgery.Correct Answer: 1.5-2 times as long as normal physiological terms of reinnervation for every upper extremity muscle group

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3429. (2958) Q8-3464:

Which of the following kinds of trauma is the most frequent cause of brachial plexus injuries:

1) Automobile trauma
3) Motorcycle trauma
2) Domestic trauma
5) Industrial trauma
4) Sports trauma

Motorcycle trauma causes brachial plexus injuries more frequently than automobile trauma, domestic trauma, sports trauma, and industrial trauma. The high speed at which many motocyclists travel, as well as the unprotected position of motorcyclistsâ arms and shoulder girdles, cause brachial plexus injuries in motorcyclists.Correct Answer: Motorcycle trauma

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3430. (2959) Q8-3465:

Which of the following branches of spinal nerve radices are damaged in patients with brachial plexus injuries:

1) C_5-C_6
3) C_7-T_1
2) C_7-C_8
5) C_8-T_4
4) C_5-T_1

The C_5-T_1 spinal nerve branches help form the brachial plexus, which innervates the upper extremity. If the brachial plexus is completely damaged, then the superior monoplegia should be examined. Patients with partial brachial plexus injuries may develop Duchenne-Erb paralysis or Klumpke's paralysis if their C_5-C_6 and C_7-T_1 spinal nerve branches are damaged.Correct Answer: C_5-T_1

3431. (3546) Q8-4534:

The rigidity of an external fixator can be increased by:

1) Decreasing the distance between the bone and rods
3) Decreasing pin diameter
2) Decreasing the number of pins
5) Increasing the distance between fragment pin sets
4) Separating the half pins by less than 30Âº when applying anterior and anteromedial frames

Many factors determine the rigidity of a frame. The pin holes should be less than 30% of the bone diameter to decrease the risk of open section fracture. The bending stiffness of the pin is proportional to half the radius to the fourth power. Therefore, increasing the pin diameter to less than 30% of the bone diameter will increase the rigidity of the external fixator. Tubular rods with an 11-mm diameter are approximately twice as stiff as solid connecting rods with an 8-mm diameter. Increasing the pin spread within each bone segment to 9 cm triples the resistance to anteroposterior bending. Decreasing the bone rod distance to 2.5 cm leads to a threefold increase in resistance to transverse bending. Another way to increase stiffness of the frame is to separate half pins by greater than 45Â° when applying anterior and anteromedial frames together.Correct Answer: Decreasing the distance between the bone and rods

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3432. (3694) Q8-7472:

Intramedullary nail fixation of an extra-articular proximal third tibial fracture is commonly associated with what malreduction deformity of the fracture site:

1) Apex posterior (hyperextension)
3) External rotation
2) Varus, apex anterior, and anterior displacement of the distal fragment
5) Valgus, apex anterior, and anterior displacement of the distal fragment
4) Valgus, apex anterior, and posterior displacement of the distal fragment

Proximal tibial fractures treated with an intramedullary nail without the use of special techniques to aid reduction are usually associated with the following deformities:

- Valgus
- Apex anterior
- Posterior displacement of the distal fragment

Correct Answer: Valgus, apex anterior, and posterior displacement of the distal fragment

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3433. (3695) Q8-7473:

Techniques that may be useful to avoid malreduction during intramedullary nailing of a proximal tibia fracture include all of the following except:

1) Nailing in a semi-extended position
3) Use of blocking screws
2) Use of a small fragment plate with unicortical screws
5) Use of a more lateral and proximal entry site
4) Use of a bump to obtain additional knee flexion

Flexion of the knee increases the apex anterior angulation deformity due to the pull of the patella tendon. All of the other techniques have been described to avoid malreduction during intramedullary nailing of proximal tibial fractures.Correct Answer: Use of a bump to obtain additional knee flexion

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3434. (3696) Q8-7474:

To prevent apex anterior deformity during intramedullary nailing of proximal third tibial fractures, a blocking screw should be placed in what location:

1) Anterior to the intended ideal path of the nail
3) Medial to the intended ideal path of the nail
2) Posterior to the intended ideal path of the nail
5) Two screws should be placed obliquely to adequately block the deformity.
4) Lateral to the intended ideal path of the nail

To prevent apex anterior deformity, a blocking screw is placed from medial to lateral just posterior to the intended ideal posterior location of the intramedullary nail.Correct Answer: Posterior to the intended ideal path of the nail

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3435. (3697) Q8-7475:

To prevent valgus deformity during intramedullary nailing of proximal third tibial fractures, a blocking screw should be placed in what location:

1) Anterior to the intended ideal path of the nail
3) Medial to the central axis of the tibia
2) Posterior to the intended ideal path of the nail
5) Blocking screws are not useful in preventing valgus deformity.
4) Lateral to the central axis of the tibia

To prevent valgus angulation, a blocking screw should be placed just lateral to the central axis of the tibia. As the nail is passed medial to the locking screw, the deformity is corrected.Correct Answer: Lateral to the central axis of the tibia

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3436. (3698) Q8-7476:

To prevent the less common varus deformity during intramedullary nailing of proximal third tibial fractures, a blocking screw should be placed in what location:

1) Anterior to the intended ideal path of the nail
3) Medial to the central axis of the tibia
2) Posterior to the intended ideal path of the nail
5) Blocking screws are not useful in preventing valgus deformity
4) Lateral to the central axis of the tibia

While a valgus deformity is most commonly seen when nailing a proximal third tibial fracture, correction of varus angulation can be achieved by placing a blocking screw just medial to the central axis of the tibia.

To prevent valgus angulation, a blocking screw should be placed just lateral to the central axis of the tibia. As the nail is passed medial to the locking screw, the deformity is corrected.

Correct Answer: Medial to the central axis of the tibia

3437. (3699) Q8-7477:

Which of the following statements is true concerning rotational deformities that can occur with intramedullary nailing of femoral fractures:

1) They are very uncommon (less than 5% incidence).
3) They rarely cause any functional complication, even when greater than 15Â°.
2) More than 80% are internal rotation deformities.
5) They rarely occur when the nailing is done on a fracture table.
4) Internal rotational deformities are better tolerated than external rotational deformities.

In a study of 76 patients who underwent intramedullary femoral nailing on a fracture table, Jaarsma and colleagues found that 28% (21 patients) had a rotational deformity of 15Â· or more. Twelve of these were external rotation deformities and nine were internal rotation deformities. They reported that patients with a rotational deformity had difficulties with activities like running, sports, and climbing stairs. Patients with an external rotational malalignment had more functional problems than patients with an internal rotational malalignment.

Correct Answer: Internal rotational deformities are better tolerated than external rotational deformities.

3438. (3700) Q8-7478:

Which of the following radiographic findings provides the best assessment of femoral rotational alignment during intramedullary nailing of a comminuted femoral shaft fracture:

1) Mechanical axis
3) Profile of the lesser trochanter
2) Anatomic axis
5) Outer diaphyseal diameter
4) Cortical thickness

While comparison of the cortical thickness and comparison of the inner and outer diaphyseal diameters are useful in assessing the accuracy of rotational alignment, comparison of the profile of the lesser trochanter between the injured and the uninjured limb likely provides the best assessment of rotational alignment, especially in a comminuted fracture. Assessment of the mechanical and anatomic axis is useful for assessing varus or valgus deformities but is not useful for assessing rotational alignment.

Correct Answer: Profile of the lesser trochanter

3439. (3701) Q8-7479:

To assess femoral rotation using computed tomography (CT) scan, a line is drawn along the posterior border of the femoral condyles and another line drawn through the femoral neck. If the angle between these two lines is increased compared to the uninjured side, there is:

1) Increased external rotation of the distal fragment
3) Decreased external rotation of the distal fragment
2) Increased internal rotation of the distal fragment
4) Decreased internal rotation of the distal fragment

Jeanmart and colleagues described a technique for evaluating femoral malrotation using limited CT cuts through the proximal and distal femur. A line is drawn along the posterior border of the femoral condyles and another line drawn through the femoral neck. The angle between these two lines is measured and any difference between the injured and uninjured sides is compared. A decrease in angle of the fractured side indicates increased external rotation of the distal fragment, while an increase of this angle indicates an increased internal rotation of the distal femoral fragment.

Correct Answer: Increased internal rotation of the distal fragment

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3440. (3728) Q8-7508:

The incidence of radial nerve palsy in patients sustaining a humeral shaft fracture is:

1) Less than 1%
3) About 10%
2) Less than 5 %
5) About 30 %
4) About 20 %

Correct Answer: About 10%

3441. (3729) Q8-7509:

Spontaneous recovery of a radial nerve palsy associated with a humeral shaft fracture can be expected to occur:

1) About 88% of the time
3) Significantly less frequently in secondary palsies
2) About 98% of the time
5) Only if the nerve is explored operatively
4) Significantly less frequently in primary palsies

In the literature review by Shao and investigators there was no significant difference in the recovery rate between primary (occurring at the time of injury) and secondary (occurring after the injury, or as a result of a closed reduction) nerve palsies. The recovery rate in primary nerve palsies was 88.6% and 93.1% in secondary nerve palsies.

Correct Answer: About 88% of the time

3442. (3730) Q8-7510:

Secondary radial nerve palsies occurring as a result of fracture manipulation are:

1) Absolute indications for surgical exploration
3) Similar in the rate of recovery to primary nerve palsies
2) Highly uncommon (< 2% of radial nerve palsies)
5) Only seen with Holstein-Lewis fracture patterns
4) More commonly nerve lacerations than primary nerve palsies

Approximately 10% to 20% of nerve palsies develop during the course of treatment, commonly noted following a closed reduction, and are termed secondary nerve palsies. When a radial nerve palsy develops following fracture manipulation (secondary radial nerve palsy), many surgeons have advocated radial nerve exploration because this scenario suggests that the radial nerve might be entrapped within the fracture.

However, in the literature review by Shao and investigators there was no significant difference in the recovery rate between primary (occurring at the time of injury) and secondary (occurring after the injury, or as a result of a closed reduction) nerve palsies. The recovery rate in primary nerve palsies was 88.6% and 93.1% in secondary nerve palsies. The authors of this study did not state whether there was a different rate of operative treatment in these two groups.

Shah and Bhatti reported on 17 patients who developed secondary radial nerve palsies. Eight patients were treated with surgical exploration. Although all of the nerves were found to be intact, three were impinged on the fracture fragments and one was entrapped in scar. The other nine patients were managed nonoperatively. All patients with secondary paralysis had complete functional recovery of the radial nerve.

Based on the available literature, no strong evidence indicates that all secondary radial nerve palsies require immediate surgical exploration.

Correct Answer: Similar in the rate of recovery to primary nerve palsies

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3443. (3731) Q8-7511:

Fracture patterns associated with the greatest incidence of radial nerve palsy are:

1) Comminuted fractures
3) Segmental fractures
2) Oblique fractures
5) Bilateral fractures
4) Transverse and spiral fractures

In a review of the literature by Shao and colleagues, transverse and spiral fracture patterns were significantly (P < .001) more likely to be associated with a radial nerve palsy than oblique or comminuted fractures

Fracture pattern	**Incidence**	**# Palsies/# Total fractures**
Transverse	21.2%	47/222
Spiral	19.8%	19/96
Oblique	8.4%	15/179
Comminuted	6.8%	26/382

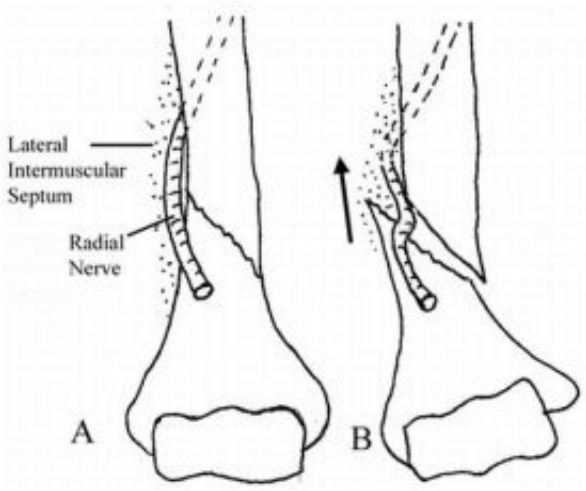
Correct Answer: Transverse and spiral fractures

3444. (3732) Q8-7512:

The classic Holstein-Lewis fracture pattern is:

1) A spiral fracture of the distal third of the humerus in which the radial nerve may be entrapped in the fracture
3) A spiral fracture of the middle third of the humerus in which the radial nerve may be entrapped in the fracture
2) A spiral fracture of the distal third of the humerus in which the radial nerve is commonly lacerated by the sharp fracture edge
5) A fracture pattern which is an absolute indication for radial nerve exploration when a palsy is present
4) A spiral fracture of the middle third of the humerus in which the radial nerve is commonly lacerated by the sharp fracture edge

In 1963 Holstein and Lewis[7] reported on seven cases of radial nerve palsy that occurred in humeral shaft fractures. They stated that in their experience radial nerve palsies occurred when the fracture pattern was a spiral fracture of the distal humerus in which the distal bone fragment was displaced proximally with its proximal end deviated radialwards entrapping the radial nerve (Slide). Holstein and Lewis recommended operative treatment when a radial nerve palsy was associated with this fracture pattern and location. Holstein and Lewis recommended operative treatment when a radial nerve palsy was associated with this fracture pattern and location. While laceration of the nerve is possible, it is far less common than neuropraxia due to stretch or compression at the fracture site.



Slide. Diagram of Holstein-Lewis fracture pattern. The radial nerve pierces the lateral intermuscular septum as it traverses from posterior to anterior (A). Proximal and varus displacement of a spiral fracture of the distal third of the humerus may result in the radial nerve being trapped in the fracture site (B). (Image courtesy of David J. Hak, MD, MBA)

In the series of radial nerve palsies reported by Shah and colleagues[6], 11 patients had Holstein-Lewis fractures. Eight of these were primary palsies, while three were secondary palsies. Nine patients were treated conservatively, and two had surgical exploration of the radial nerve. In one of the patients with a secondary palsy treated operatively, the radial nerve was found to be caught in the fracture fragments. Ten patients were available for follow-up examination and all had complete recovery of radial nerve function.

The author agrees with Shao and researchers[2] who stated that the special relationship between this fracture pattern and radial nerve palsy is not as strong as Holstein and Lewis suggested. As such, a spiral fracture pattern of the distal humerus with associated nerve palsy is not an absolute indication for radial nerve exploration.

Correct Answer: A spiral fracture of the distal third of the humerus in which the radial nerve may be entrapped in the fracture

3445. (3734) Q8-7514:

When comparing intramedullary nailing with compression plate fixation of humeral shaft fractures, the use of intramedullary nailing is associated with an increased risk of:

1) Infection
3) Malunion
2) Iatrogenic nerve injury
5) Reoperation
4) Nonunion

A meta-analysis performed on the oldest three studies (Rodriguez-Merchan, Chapman and colleagues, and McCormack and researchers) indicated that plate fixation provided a risk reduction of 74% for reoperation; however, this is in large part due to the inclusion of the 19 patients who underwent removal of their retrograde flexible nails. The meta-analysis indicated that plate fixation also reduced the risk of shoulder complications, which is likely a valid finding because it included 51 antegrade interlocked intramedullary nails.

A subsequent analysis of the three studies that used interlocked intramedullary nails (Chapman and colleagues, McCormack and investigators, and Changulani and researchers) also reported an increase in the risk of reoperation when intramedullary nailing was performed. This analysis found no significant difference in the percentage of patients developing nonunion, infection, or iatrogenic nerve injury.

Correct Answer: Reoperation

3446. (3735) Q8-7515:

Approximately how frequently does iatrogenic nerve injury occur as a result of compression plate fixation in the humerus:

1) 2%
3) 10%
2) 5%
5) 20%
4) 15%

Gregory and Sanders summarized the results of several individual studies of humeral shaft fixation. Pooled data from six studies involving 302 fractures treated with compression plate fixation found no functional problems of the shoulder or elbow, 11 nonunions, 6 iatrogenic nerve palsies, and 10 infections.Correct Answer: 2%

3447. (3736) Q8-7516:

When comparing compression plate fixation with antegrade interlocked intramedullary nailing of humeral shaft fractures, the use of compression plate fixation is associated with a reduced risk of:

1) Malunion
3) Shoulder pain
2) Nonunion
5) Radial nerve palsy
4) Infection

A meta-analysis performed on three randomized studies (Rodriguez-Merchan, Chapman and colleagues, and McCormack and researchers) indicated that plate fixation reduced the risk of shoulder complications.

A subsequent analysis of the three studies that used interlocked intramedullary nails (Chapman and colleagues, McCormack and investigators, and Changulani and researchers) found no significant difference in the percentage of patients developing nonunion, infection, or iatrogenic nerve injury.

Correct Answer: Shoulder pain

3448. (3737) Q8-7517:

In the prospective randomized study by Chapman and colleagues that compared compression plate fixation with intramedullary nailing, the loss of elbow motion in patients treated with plate fixation was associated with:

1) Anterolateral surgical approach
3) Use of a broad, large fragment plate
2) Posterior surgical approach
5) Comminuted fractures
4) Fractures in the distal third of the diaphysis

Chapman and colleagues performed a prospective study of 89 patients with humeral shaft fractures. Patients were randomized to treatment with a locked antegrade nail or compression plate fixation. Follow-up averaged 13 months. Similar rates of healing were seen by 16 weeks, with 93% of patients healing with plate fixation and 87% of patients healing with intramedullary nailing. A significant (P = .007) incidence of shoulder pain and decreased shoulder range of motion were seen with intramedullary nailing. Shoulder complications developed in 10 of the 32 patients (31%) treated with intramedullary nailing. In comparison, a significant (P = .03) decrease in elbow range of motion was seen in the plate fixation group, especially for fractures of the distal third of the diaphysis. Other complications were similar between the two groups. The investigators concluded that for patients requiring surgical treatment of a humeral shaft fracture, intramedullary nailing and compression plating both provide predictable methods for achieving fracture stabilization and ultimate healing.Correct Answer: Fractures in the distal third of the diaphysis

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3449. (3738) Q8-7518:

When comparing antegrade interlocked intramedullary nailing with compression plate fixation of humeral shaft fractures, the use of intramedullary nailing is associated with an increased risk of:

1) Infection
3) Shoulder dysfunction
2) Iatrogenic nerve injury
5) Delayed union
4) Elbow stiffness

The rate of shoulder pain and dysfunction following antegrade interlocked humeral nails ranges from 16% to 37%. It is commonly believed that this complication is due to injury to the rotator cuff during nail insertion. To minimize complications, surgeons have recommended cutting the rotator cuff in-line with its fibers, careful retraction, and meticulous repair following nail insertion.Correct Answer: Shoulder dysfunction

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3450. (3790) Q8-7572:

In young patients sustaining a high-energy femoral shaft fracture, all of the following are recommended to minimize the risk of missing an ipsilateral femoral neck fracture except:

1) A thin-cut computed tomography (CT) scan through the hip
3) A dedicated internal rotation hip view at follow-up
2) A careful intraoperative fluoroscopic examination of the hip
5) A dedicated hip film when patients complain of hip pain
4) A dedicated external rotation hip view immediately postoperative

While dedicated internal rotation hip views are useful, dedicated external rotation hip views are not indicated. Because the femoral neck is anteverted, internal rotation of the hip is necessary to bring the axis of the femoral neck perpendicular to the radiographic beam.

Tornetta and colleagues described the use of a thin-cut computed tomography scan and dedicated anteroposterior (AP) internal rotation views of the femoral neck to decrease the incidence of missed femoral neck fractures. In addition, they recommend carefully examining the intraoperative lateral hip fluoroscopic view and obtaining dedicated AP internal rotation views of the hip at follow-up. At follow-up, patients were questioned about the presence of hip pain and, if positive, were imaged with tomography.

In the year prior to the institution of the protocol, seven (9%) of eighty-two patients with a femoral shaft fracture were found to have an associated femoral neck fracture. Four of those fractures were not diagnosed during the preoperative work-up or while in the operating room. Three of these four fractures were displaced when they were diagnosed and required additional surgical treatment.

After the institution of the protocol, the incidence of missed femoral neck fractures dropped from 57% to 6.3% (Table).

Table. Comparison of the Detection of Associated Femoral Neck Fractures Before and After Initiation of Protocol[1]

	Number of patients with femoral shaft fracture	Number of patients with neck and shaft fractures	Prevalence of neck and shaft fractures (%)	Delayed diagnosis of femoral neck fracture	
				Number	Prevalence (%)
Pre-protocol	82	7	9%	4	57%
Post-protocol	254	16	6%	1	6.3%

Correct Answer: A dedicated external rotation hip view immediately postoperative

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3451. (3791) Q8-7573:

Ipsilateral femoral neck and shaft fractures are most commonly seen in what situation:

1) Older patients sustaining low-energy falls
3) Young patients sustaining low-energy falls
2) Older patients sustaining high-energy injuries
5) Both young and old patients sustaining high-energy injuries
4) Young patients sustaining high-energy injuries

Ipsilateral femoral neck and shaft fractures typically occur in young patients (median age 34 years) sustaining high-energy injuries. It has been postulated that this injury pattern occurs as a result of an axially directed force, such as a motor vehicle accident in which the knee strikes the dashboard. The axial force causes both a fracture of the femoral neck and a comminuted fracture of the femoral diaphysis. Due to the mechanism of injury, associated knee injuries are commonly seen, including patella fractures, contusions, and lacerations. In a meta-analysis of 659 patients, knee injuries were present in half of the patients. Because these frequently result from high-energy injuries, associated multisystem injuries are seen in 73% to 100% of patients.

The shaft fracture is commonly mid-diaphyseal and frequently comminuted, as is often seen in high-energy fractures. The femoral neck fracture is commonly vertical, basilar, and minimally or nondisplaced.

Correct Answer: Young patients sustaining high-energy injuries

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3452. (3792) Q8-7574:

The pattern of femoral neck fractures typically seen in association with ipsilateral femoral shaft fractures are:

1) Widely displaced and easily diagnosed
3) Nondisplaced, vertical, basicervical
2) Nondisplaced, transverse, transcervical
5) Non comminuted, subcapital
4) Severely comminuted, subcapital

The femoral neck fracture is commonly vertical, basilar, and minimally or nondisplaced. The shaft fracture is commonly mid-diaphyseal and frequently comminuted, as is often seen in high-energy fractures.

Correct Answer: Nondisplaced, vertical, basicervical

3453. (3793) Q8-7575:

Femoral neck nonunion is most commonly seen following which treatment method for an ipsilateral femoral neck and shaft fracture:

1) Reconstruction nailing
3) Lag screw fixation of femoral neck and plate fixation of shaft
2) Lag screw fixation of femoral neck and retrograde nailing of shaft
5) Dynamic hip screw fixation of femoral neck and plate fixation of shaft
4) Dynamic hip screw fixation of femoral neck and retrograde nailing of shaft

Femoral neck nonunions are more commonly seen with reconstruction nailing. Watson and Moed caution against the use of a reconstruction nail for fixation of femoral neck and shaft fractures. In their report of complications following treatment of ipsilateral femoral neck and shaft fractures, they had eight femoral neck nonunions, and six (75%) of these occurred in patients treated with a reconstruction nail. They point out that the implant was designed to provide adjunctive fixation into the head and neck to decrease the moment arm when stabilizing proximal femoral shaft fractures, not for the fixation of ipsilateral femoral neck fractures. The screws inserted through the nail into the femoral head and neck were not designed to function as compression lag screws, and they have poor sliding characteristics due to the short working length of the screw within the nail. Because of the limited sliding capacity, loading may results in impaction of the femoral head cancellous bone and potentially screw cut-out. Alternatively, if the femoral head and neck are securely anchored in strong cancellous bone, then resorption of bone at the fracture site effectively leads to a progressively increased distance between the fracture edges. Equally problematic is the inability to place screws optimally in the femoral head and neck, because the position of the screws is fixed by the location of the proximal nail holes.

Dynamic hip screw stabilization can be effectively used instead of lag screw fixation for basicervical femoral neck fractures.

Correct Answer: Reconstruction nailing

3454. (4067) Q8-7576:

A âmissedâ ipsilateral femoral neck fracture is most commonly due to:

1) Iatrogenic injury at the time of antegrade nailing
3) Failure to review patients abdominal computed tomography (CT) scan
2) Iatrogenic injury at the time of retrograde nailing
5) Malpractice, because a missed injury should never occur if standard protocols are followed
4) Inadequate preoperative imaging of the femoral neck

While iatrogenic injury can occur with a malpositioned entry site for an antegrade nail, most ipsilateral femoral neck fractures are due to the injury. Initial radiographs are often of poor quality, and the fracture may not be adequately visualized. While reviewing a patientâs abdominal CT may identify an occult femoral neck fracture, the cuts are often 1 cm width and may not adequately image the femoral neck. A thin-cut CT scan of the hip is recommended. Even in the presence of standard protocols, ipsilateral femoral neck fractures can still be missed.

Tornetta and colleagues described the use of a thin-cut CT scan and dedicated anteroposterior (AP) internal rotation views of the femoral neck to decrease the incidence of missed femoral neck fractures. In addition, they recommend carefully examining the intraoperative lateral hip fluoroscopic view and obtaining dedicated AP internal rotation views of the hip at follow-up. At follow-up, patients were questioned about the presence of hip pain and, if positive, were imaged with tomography.

In the year prior to the institution of the protocol, seven (9%) of eighty-two patients with a femoral shaft fracture were found to have an associated femoral neck fracture. Four of those fractures were not diagnosed during the preoperative work-up or while in the operating room. Three of these four fractures were displaced when they were diagnosed and required additional surgical treatment.

After the institution of the protocol, the incidence of missed femoral neck fractures dropped from 57% to 6.3%.

Correct Answer: Inadequate preoperative imaging of the femoral neck

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3455. (3891) Q8-7771:

Which of the following is an advantage of lateral positioning over supine positioning when performing antegrade intramedullary nailing of a subtrochanteric femur fracture with an intact lesser trochanter:

1) Provides improved pulmonary ventilation
3) Allows faster setup and positioning
2) Eliminates valgus sag at fracture site
5) Provides more accurate rotational alignment
4) Provides easier alignment of the distal segment to the flexed proximal segment

Subtrochanteric fractures can pose challenges in reduction due to the muscle attachments proximal and distal to the fragment. The gluteus medius and gluteus minimus attach to the greater trochanter and abduct the proximal fragment. The iliopsoas attaches to the lesser trochanter, flexing and externally rotating the proximal fragment. In the lateral position, it may be easier to align the distal fragment with the flexed proximal fragment. In the supine position, it may be necessary to place a Schantz pin in the proximal fragment to counteract the deforming forces acting on the proximal fragment.

Pulmonary ventilation is better in the supine position. In the lateral position, you must be careful to avoid valgus sag at the fracture site. Careful attention to correct rotational alignment is necessary in both the supine and lateral position.

Correct Answer: Provides easier alignment of the distal segment to the flexed proximal segment

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3456. (3892) Q8-7772:

In the Russell-Taylor classification of subtrochanteric femur fractures, a fracture involving the piriformis fossa without comminution of the lesser trochanter is classified as:

1) IA
3) IIA
2) IB
5) IIIA
4) IIB

In the Russell-Taylor classification system, a fracture involving the piriformis fossa without comminution of the lesser trochanter is classified as a type IIA.

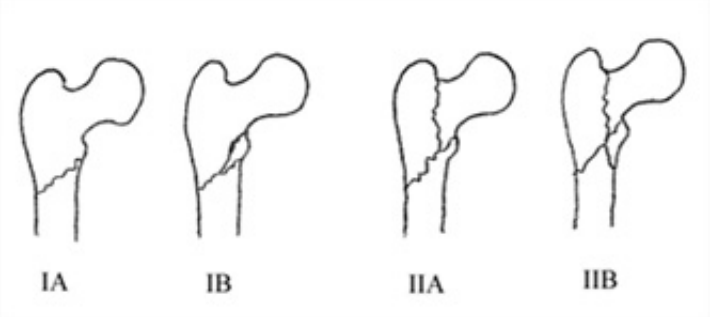
The subtrochanteric classification system proposed by Russell and Taylor focused on the integrity of the piriformis fossa and thus the practicality of using a piriformis entry intramedullary nail for fixation of the fracture. Type I fractures do not have extension into the piriformis fossa, while type II fractures involve extension into the piriformis fossa.

Each of these categories is subcategorized into two groups. In type IA, the lesser trochanter is intact, and these patterns can be fixed with a standard antegrade intramedullary nail. In type IB patterns, there is a fracture involving the lesser trochanter. A standard antegrade nail is not feasible in this pattern, as the proximal locking screw cannot achieve purchase in the lesser trochanter. Treatment of this pattern generally requires a cephalomedullary nail that has a screw, or screws, which are positioned in the femoral neck and head. Alternatively, plating with a blade plate, 95Âº dynamic condylar screw or a locking proximal femur plate may be used.

The type II fractures are also subdivided into two categories. In type IIA patterns, there is no significant comminution of the lesser trochanter. While in type IIB patterns, there is comminution of the greater trochanter along with loss of the medial femoral cortex, including the lesser trochanter. Because of the involvement of the piriformis, most surgeons have avoided the use of a piriformis entry nail in these two patterns of fractures and traditionally have relied on some from of plate stabilization.

Table. Russell-Taylor classification of subtrochanteric fractures.

Â	Â	Lesser trochanter	
Â	Â	Intact	Comminuted
Piriformis fossa	Intact	IA	IB
	Involved in fracture	IIA	IIB



Slide 1 Russell-Taylor subtrochanteric fracture classification system. In type I fractures the piriformis fossa is intact, while type II fractures are characterized by fracture extension into the piriformis fossa. In subcategory A, the lesser trochanter remains intact, while in subcategory B, the lesser trochanter is a separate comminuted fragment. (Image courtesy of David J. Hak, MD, MBA.)

Correct Answer: IIA

3457. (3893) Q8-7773:

The deformity commonly seen in a subtrochanteric femur fracture where the lesser trochanter is intact includes:

1) Adduction and extension of the proximal fragment
3) Abduction and extension of the proximal fragment
2) Adduction and flexion of the proximal fragment
5) Predominantly internal rotation of the proximal fragment
4) Abduction and flexion of the proximal fragment

The most commonly seen deformity in subtrochanteric femur fractures is abduction and flexion of the proximal fragment.

Subtrochanteric fractures can pose challenges in reduction due to the muscle attachments proximal and distal to the fragment. The gluteus medius and gluteus minimus attach to the greater trochanter and abduct the proximal fragment. The iliopsoas attaches to the lesser trochanter, flexing and externally rotating the proximal fragment. The short external rotators (piriformis, superior and inferior gemellus) and the obturator internus also cause external rotation of the proximal fragment. The adductors attaching distally result in varus and shortening.

Correct Answer: Abduction and flexion of the proximal fragment

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3458. (3894) Q8-7774:

The strength of the implant used for fixation of subtrochanteric femur fractures is critical because the subtrochanteric femur has:

1) High tensile forces medially and high compressive forces laterally
3) High torsional loads
2) High compressive forces medially and high tensile forces laterally
5) High bending loads in simple fracture patterns
4) Low compressive forces medially and high tensile forces laterally

The subtrochanteric femur is a region of high stress, placing high demands on implants used for fixation. There are high compressive forces medially, and high tensile forces laterally. When there is medial comminution, the implant used for fixation is subjected to high bending load.

Subtrochanteric fractures are generally slower to heal than intertrochanteric fractures. This slow rate of healing places additional demands on the implants.

Correct Answer: High compressive forces medially and high tensile forces laterally

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3459. (3895) Q8-7775:

Which of the following implants is least desirable for fixation of a comminuted subtrochanteric femur fracture:

1) Blade plate
3) Trochanteric entry cephalomedullary nail
2) Piriformis entry cephalomedullary nail
5) Locking proximal femur plate
4) 135Âº dynamic/sliding hip screw

The 135Âº dynamic or sliding hip screw was designed for use in intertrochanteric hip fractures. Its use in subtrochanteric fractures can be successful, but additional periosteal disruption is necessary for reduction and fixation may lead to healing problems. Additionally, the proximal fragment may rotate about the single proximal compression screw.

The use of the 135Âº dynamic or sliding hip screw is specifically problematic in reverse oblique fracture patterns. In a retrospective study of reverse oblique fractures, loss of fixation was seen in 56% (9 of 16) treated with a 135Âº dynamic or sliding hip screw, compared with 13% (2 of 16) treated with a 95Âº blade plate.

Correct Answer: 135Âº dynamic/sliding hip screw

3460. (3896) Q8-7776:

When the ankle is dorsiflexed, the fibula moves in:

1) Internal rotation and is translated laterally
3) External rotation and is translated laterally
2) Internal rotation and is translated proximally
5) External rotation and is translated proximally
4) External rotation and is translated distally

The anterior portion of the talus is wider than the posterior portion, such that when the ankle goes from plantarflexion to dorsiflexion the mortise widens by 1.5 mm. During ankle dorsiflexion, the fibula translates proximally, is externally rotated, and translates laterally. With plantarflexion, the fibula is pulled distally, internally rotated, and medially translated.

Correct Answer: External rotation and is translated proximally

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3461. (3897) Q8-7777:

Structures that make up the syndesmosis include all of the following EXCEPT:

1) Anterior inferior tibiofibular ligament (AITFL)
3) Tibiofibular interosseous ligament
2) Anterior talofibular ligament (ATFL)
5) Inferior transverse tibiofibular ligament
4) Posterior inferior tibiofibular ligament (PITFL)

The syndesmosis between the tibia and fibula at the ankle consists of five defined structures (Slide):

1. Anterior inferior tibiofibular ligament (AITFL)
2. Posterior inferior tibiofibular ligament (PITFL)
3. Inferior transverse tibiofibular ligament
4. Tibiofibular interosseous membrane
5. Tibiofibular interosseous ligament

Slide

Slide. Ligamentous structures comprising the ankle syndesmosis. IOM = interosseous membrane, IOL = interosseous ligament, AITFL = anterior inferior tibiofibular ligament, PITFL = posterior inferior tibiofibular ligament, ITL = inferior transverse tibiofibular ligament. (Image courtesy of David J. Hak, MD, MBA)

Correct Answer: Anterior talofibular ligament (ATFL)

3462. (3898) Q8-7778:

The recommended orientation for syndesmotic screw fixation with respect to the coronal plane of the tibia is:

1) Angled 15Â° posterior
3) Parallel to the posterior tibial surface
2) Angled 30Â° posterior
5) Angled 30Â° anterior
4) Angled 15Â° anterior

While variation exists in the morphology of the syndesmosis, most researchers recommend that the orientation of syndesmotic fixation be angled 25Â° to 30Â° anterior to the coronal plane (Slide). The fibula normally sits in the incisura, which is oriented posterolaterally.

Slide 6

Slide Because of the location of the syndesmosis, most researchers recommend that the orientation of syndesmotic fixation be angled 25Â° to 30Â° anterior to the coronal plane. (Image courtesy of David J. Hak, MD, MBA)

Correct Answer: Angled 30Â° anterior

3463. (3899) Q8-7779:

Laboratory and clinical studies clearly demonstrate that the optimal syndesmotic fixation is achieved with which of the following constructs:

1) A single 3.5-mm cortical screw placed through 3 cortices
3) Two 3.5-mm cortical screws placed through 3 cortices
2) A single 4.5-mm cortical screw placed through 4 cortices
5) None of the above have been shown to be clearly superior
4) Two 4.5-mm cortical screws placed through 4 cortices

Controversy exists concerning the optimal syndesmotic fixation. Laboratory and clinical studies have failed to clearly indicate that one fixation technique is superior to another.

There is conflicting data concerning whether a larger diameter screw is superior. Using tricortical fixation, one biomechanical study found no difference between using a 4.5-mm and a 3.5-mm diameter screw. However, in another biomechanical study using quadricortical fixation, the 4.5-mm diameter screw had significantly higher resistance to shear stress during weightbearing.

Disagreement exists whether the syndesmotic screw should engage three or four cortices. Proponents of engaging four cortices claim that if the screw should break it can still be removed by grabbing the far screw tip. Proponents of engaging only three cortices claim that screw failure is less common, because the screw can move (windshield wiper) in the metaphyseal bone.

Investigators performed a prospective randomized study comparing three vs four cortices of syndesmotic screw fixation in 64 patients. The investigators routinely removed the quadricortical screws at 2 months but only removed the tricortical screws if they were symptomatic. Two tricortical screws that loosened were removed. The patients Olerud and Molander functional scores were significantly better in the tricortical group at 3 months (77 points vs 66 points, P=.025), but at 1 year there was no significant difference (92.6 points vs 85.7 points, P=.017).

In another surgeon randomized study comparing three vs four cortices of fixation, investigators found no difference in the rate of hardware breakage or reduction loss.

Correct Answer: None of the above have been shown to be clearly superior

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3464. (3900) Q8-7780:

Which of the following static radiographic measurements suggests syndesmotic disruption:

1) Tibiofibular overlap of 50% on anteroposterior (AP) view
3) Tibiofibular overlap of 7 mm on AP view
2) Tibiofibular overlap of 2 mm on mortise view
5) Tibiofibular clear space of 5 mm on mortise view
4) Tibiofibular clear space of 7 mm on AP view

Tibiofibular overlap measures the overlap of the two bones at a distance 1 cm proximal to the ankle joint (Slide 1). On the AP view, the tibiofibular overlap should be greater than 6 mm or greater than 42% of the width of the fibula, while on the mortise view , the tibiofibular overlap should be greater than 1 mm.9

Slide 1

Slide 1. The tibiofibular overlap measures the overlap of the two bones at a distance 1 cm proximal to the ankle joint. On the AP view, the tibiofibular overlap should be greater than 6 mm or greater than 42% of the

width of the fibula, while on the mortise view , the tibiofibular overlap should be greater than 1 mm. (Image courtesy of David J. Hak, MD, MBA)

The tibiofibular clear space is defined as the distance between the medial border of the fibula and the lateral border of the incisura (Slide 2). Measured 1 cm proximal to the ankle joint, the tibiofibular clear space should be greater than 6 mm on the AP and mortise views.[9]

Slide 2

Slide 2. The tibiofibular clear space is defined as the distance between the medial border of the fibula and the lateral border of the incisura. Measured 1 cm proximal to the ankle joint, the tibiofibular clear space should be less than 6 mm on the AP and mortise views. (Image courtesy of David J. Hak, MD, MBA)

Correct Answer: Tibiofibular clear space of 7 mm on AP view

3465. (3981) Q8-8233:

The difference between a Pipkin type I fracture and Pipkin type II fracture is:

1) Size of the femoral head fracture fragment
3) Location of the femoral head fracture
2) Degree of comminution
5) Direction of the hip dislocation
4) Presence of associated femoral neck fracture

The difference between a Pipkin type I fracture and a Pipkin type II fracture is the location of the femoral head fracture. A Pipkin type I fracture is infrafoveal, whereas a Pipkin type II fracture is suprafoveal. A femoral head fracture with an associated femoral neck fracture is classified as a Pipkin type III fracture. The Brumback classification differentiates based on the direction of the hip dislocation, whereas the simpler Pipkin classification does not include this information.

Correct Answer: Location of the femoral head fracture

3466. (3982) Q8-8234:

Which of the following is an indication for nonoperative treatment of a femoral head fracture:

1) A Pipkin type I fracture with 3 mm of displacement
3) A Pipkin type III fracture
2) A Pipkin type II fracture with 3 mm of displacement
5) A Pipkin type I fracture with concentric reduction and a stable hip
4) A comminuted Pipkin type I fracture with nonconcentric reduction

Following closed reduction of the hip, nonoperative treatment can be considered for Pipkin type I and type II fractures if the following criteria are met:

1. Anatomic or near anatomic reduction with < 2 mm displacement
2. A stable hip
3. No interposed fragments preventing a congruent hip reduction

While many Pipkin type I fractures can be treated nonoperatively, it is unusual to be able to successfully treat Pipkin type II fractures nonoperatively.

Pipkin type III fractures, which require operative treatment, are femoral head fractures associated with a femoral neck fracture.

Correct Answer: A Pipkin type I fracture with concentric reduction and a stable hip

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3467. (3983) Q8-8235:

Recommended implants for internal fixation of femoral head fractures include all of the following except:

1) Countersunk 3.5-mm screws
3) Herbert screws (Zimmer Corp., Warsaw, IN)
2) Countersunk cannulated 3.5-mm screws and washers
5) Bioabsorbable implants
4) Acutrak screws (Acumed LLC, Hillsboro, OR)

Fracture fixation can be accomplished with standard 3.5-mm or 2.7-mm countersunk lag screws, self-compressing screws (Herbert screws), or bioabsorbable pins.9 The use of 3.5-mm cannulated screws and washers is not advised because investigators have reported dissociation of the washer from the screw head with production of third body degenerative changes of the hip.

Correct Answer: Countersunk cannulated 3.5-mm screws and washers

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3468. (3984) Q8-8236:

A femoral head fracture associated with a femoral neck fracture is classified as a:

1) Pipkin type I fracture
3) Pipkin type III fracture
2) Pipkin type II fracture
5) Pipkin type V fracture
4) Pipkin type IV fracture

A femoral head fracture associated with a femoral neck fracture is classified as a Pipkin type III fracture. A Pipkin type I fracture refers to an infrafoveal femoral head fracture. A Pipkin type II fracture refers to a suprafoveal femoral head fracture. A Pipkin type IV fracture refers to a femoral head fracture associated with an acetabular fracture. While the Brumback classification includes a type V, the simpler Pipkin classification only includes types I to IV.

Correct Answer: Pipkin type III fracture

3469. (3985) Q8-8237:

Disadvantages of the anterior approach for fixation of femoral head fractures include which of the following:

1) Higher rate of avascular necrosis
3) Higher rate of sciatic nerve palsy
2) Higher rate of heterotopic ossification
5) Greater difficulty inserting lag screws
4) Poorer functional outcome

In a study by Swiontkowksi and colleagues, the use of the anterior approach was associated with a significantly higher incidence of heterotopic ossification. The anterior approach avoids additional compromise to the femoral head blood supply, and allows easier access to the femoral head fracture fragment, which is usually anteromedial.

The use of the Kocher-Langenbeck posterior approach is reported to have a 3.2 times higher incidence of subsequent avascular necrosis then the Smith-Petersen approach. However, in one study the use of the anterior approach was associated with a significantly higher incidence of heterotopic ossification. The anterior approach avoids additional compromise to the femoral head blood supply and allows easier access to the femoral head fracture fragment, which is usually anteromedial.

The rate of traumatic sciatic nerve palsy has been reported from 10% to 23%. Iatrogenic sciatic nerve palsy can occur due to traction during a posterior approach, but it would be uncommon to occur following an anterior approach.

Correct Answer: Higher rate of heterotopic ossification

3470. (3987) Q8-8239:

The highest rate of associated nerve injury in sacral fractures occurs with:

1) Denis zone 1, which is a fracture lateral to the foramen
3) Denis zone 2, which is a fracture through the foramen
2) Denis zone 1, which is a fracture medial to the foramen
5) Denis zone 3, which is a fracture medial to the foramen
4) Denis zone 3, which is a fracture lateral to the foramen

In a series of 236 patients, Denis and researchers reported the highest rate of associated nerve injuries occurred in fractures that were medial to the foramen and extending into the spinal canal. This location is classified as a Denis zone 3 fracture. The lowest rate of associated nerve injury was found with Denis zone 1 fractures, which are lateral to the foramen. Denis zone 2 fractures, which occur through the foramen, had an intermediate incidence of nerve injury.

Correct Answer: Denis zone 3, which is a fracture medial to the foramen

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3471. (3988) Q8-8240:

Associated neurologic injury is present in what percentage of sacral fractures:

1) 5%
3) 25%
2) 15%
5) 75%
4) 45%

Sacral fractures occur in approximately 45% of pelvic fractures; an associated neurologic injury of the lumbosacral plexus may occur in 25% of sacral fractures.

Correct Answer: 25%

3472. (3989) Q8-8241:

The fixation construct shown to provide optimal fixation of an unstable vertically displaced transforminal sacral fracture is:

1) An iliosacral screw into the S1 vertebral body
3) Tension band plate fixation
2) Iliosacral screws in S1 and S2
5) An iliosacral screw that traverses the S1 vertebral body and achieves purchase in the opposite iliac wing
4) Triangular osteosynthesis

The term triangular osteosynthesis describes fixation constructs that involve placement of pedicle screws in the lower lumbar and the posterior ilium in conjunction with iliosacral screws. In a biomechanical study, triangular osteosynthesis was shown to be superior to iliosacral screws alone for fixation of unstable transforaminal sacral fractures.

Correct Answer: Triangular osteosynthesis

3473. (3990) Q8-8242:

A vertical fracture lateral to the sacral foramen is classified as a:

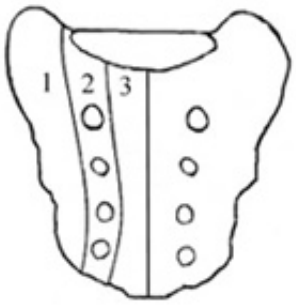
1) Denis zone 1 fracture
3) Denis zone 3 fracture
2) Denis zone 2 fracture
5) Roy-Camille type 1 fracture
4) I-shaped fracture

This fracture is classified as a Denis zone 1 pattern. The Denis classification divides the sacrum into three zones (Slide 1):

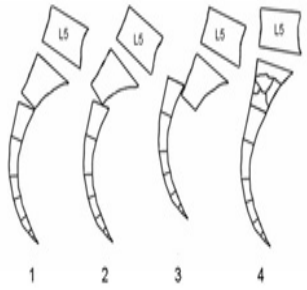
Zone 1: Fractures are located lateral to the neural foramina.
Zone 2: Fractures pass through the foramina.
Zone 3: Fractures are located medial to the foramen and involve the spinal canal.

While transverse sacral fractures have been described based on the pattern morphology as H, U, lambda, and T, a simple vertical fracture would not usually be classified by the letter âIâ morphology.

Roy-Camille and colleagues, and Strange-Vognsen and Lebech further classified transverse Denis zone 3 fractures. In this classification, type 1 fractures show only kyphotic angulation at the fracture. Type 2 fractures have kyphosis and partial anterior translation. Type 3 fractures have kyphosis along with complete translation. Type 4 fractures have segmental comminution of the S1 body due to axial compression (Slide 2).



Slide 1: The Denis classification of sacral fractures is illustrated. (Image courtesy of David J. Hak, MD, MBA)



Slide 2: The descriptive patterns of transverse sacral fractures are illustrated: A = H pattern, B = U pattern, C = lambda pattern, and D = T pattern. (Image courtesy of David J. Hak, MD, MBA)

Correct Answer: Denis zone 1 fracture

3474. (3991) Q8-8243:

To assess a patient for potential injury to the S2 nerve root following a sacral fracture, the examiner should:

1) Test great toe dorsiflexion
3) Test sensation in the 1st web space of the foot
2) Test ankle toe plantarflexion
5) Test perianal sensation
4) Test sensation on the medial border of the foot

Associated neurologic injury, especially of the lower sacral plexus, may not be appreciated unless a thorough examination is performed. Injuries to the S2 to S5 nerve roots can be overlooked because they do not supply motor or sensory supply to the lower leg. The S2 nerve innervates the musculature that forms the external urethral and anal sphincters. S4 and S5 nerves provide sensation to the penis, labia, urethra, posterior scrotum, and anal canal. The bladder and rectum are innervated primarily by the pelvic splanchnic autonomic nerves from S2 to S4. Continence and sexual function require at least unilateral preservation of the S2 and S3 nerve roots.

Clinical examination of patients sustaining sacral fractures requires more than routine examination of lower extremity sensory and motor function. Additional examination is required to identify injuries to the lower sacral plexus. A rectal examination should be performed to evaluate sphincter contraction. Light touch and pinprick sensation must be assessed for the perianal dermatomes of S2 to S5. In addition to the perianal wink, the bulbocavernosus and cremasteric reflexes must also be assessed.

Extensor hallicus longus (great toe dorsiflexion) is innervated by the deep peroneal nerve. Flexor hallicus longus (great toe plantarflexion) is innervated by the tibial nerve. The medial border of the foot is innervated by the L4 dermatome, and the lateral border of the foot is innervated by the S1 dermatome. The 1st web space is innervated by the L5 dermatome (deep peroneal nerve).

Correct Answer: Test perianal sensation

3475. (4) Q9-32:

The diameter of the nidus in most osteoid osteomas is:

1) 1 mm-2 mm
3) 15 mm-30 mm
2) 5 mm-10 mm
5) 50 mm-75 mm
4) 30 mm-50 mm

Osteoid osteomas, by strict definition, have a limited growth potential. The nidus is typically 5 mm-10 mm and is never over 1.5 cm. The nidus is lytic in appearance and often has an area of central ossification. There may be large amounts of reactive bone formation that surround the nidus.

Correct Answer: 5 mm-10 mm

3476. (5) Q9-33:

Which of the following statements is true concerning osteoid osteomas:

1) Location in the vertebral body is common.
3) The femoral neck is the single most common site.
2) Location in flat bones is common.
5) Craniofacial involvement is common.
4) In long bones, the lesions are most likely in the mid-diaphysis.

Osteoid osteomas have some specific locations to remember:

The ends of long bones

- Femoral neck (most common location)

Vertebra

- Usually in lamina or base of the pedicle
- Virtually never in the vertebral body

Highly unlikely locations

- Flat bones
- Craniofacial bones

Correct Answer: The femoral neck is the single most common site.

3477. (6) Q9-34:

Which of the following describes the presentation of a patient with an osteoid osteoma:

1) Pain with weight bearing
3) Pain relieved by aspirin and nonsteroidal anti-inflammatory drugs
2) Hard mass but no pain
5) Morning stiffness
4) Intermittent discomfort relieved by rest

Osteoid osteomas have one of the most characteristic presentations of all bone tumors. The pain is often completely relieved with aspirin and nonsteroidal anti-inflammatory drugs. Parents of affected children have stated that their child will finish a whole bottle of aspirin in 1 week. The pain commonly occurs at night and will wake the child if he or she does not take some form of medication.

Correct Answer: Pain relieved by aspirin and nonsteroidal anti-inflammatory drugs

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3478. (7) Q9-35:

When osteoid osteomas occur in the spine, they are most commonly located:

1) Beneath the anterior longitudinal ligament
3) In the spinous process
2) In the vertebral body
5) In the transverse process
4) In the lamina or base of the pedicle

When osteoid osteomas occur in the spine, they are most commonly located in the lamina or the base of the pedicle. Generally, they do not occur in the vertebral bodies, spinous processes, or transverse processes.

Common location

- In the lamina or base of the pedicle

Uncommon locations

- Vertebral body
- Spinous process
- Transverse process

Correct Answer: In the lamina or base of the pedicle

3479. (8) Q9-36:

Which of the following describes the radiographic features of an osteoid osteoma:

1) Ovoid, compact, and heavily mineralized intramedullary lesion with thorny spicules
3) Surface lesion with spiculated bone formation
2) Large, nodular, and heavily mineralized lesion on the surface of the bone
5) Cortically based lytic metaphyseal lesion with a sclerotic border
4) Well-demarcated nidus surrounded by a distinct zone of sclerosis

Osteoid osteomas have a common radiographic appearance:

- 5 mm-10 mm lytic nidus surrounded by sclerosis

The other possible answers describe the radiographic features of other lesions:

- **Bone island:** Ovoid, compact, and heavily mineralized intramedullary lesion with thorny spicules
- **Parosteal osteosarcoma:** Large, nodular, heavily mineralized lesion on the surface of the bone
- **Periosteal osteosarcoma:** Surface lesion with spiculated bone formation
- **Non-ossifying fibroma:** Cortically based lytic metaphyseal lesion with a sclerotic border

Correct Answer: Well-demarcated nidus surrounded by a distinct zone of sclerosis

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3480. (9) Q9-37:

Which of the following describes the microscopic features of osteoid osteoma:

1) Interlacing network of bone trabeculae in a loose, vascular, and stromal connective tissue
3) Scattered giant cells in a mononuclear cell background with chicken-wire calcification
2) Compact cortical bone
5) Prominent mature bone formation and low-grade malignant spindle cell tumor
4) Pleomorphic spindle cells with osteoid production

Osteoid osteomas have a characteristic histologic appearance. The nidus has an interlacing network of bone trabeculae in a loose, vascular, and stromal connective tissue. There is densely sclerotic bone surrounding the lesion.

The other possible answers describe specific lesions:

- **Bone island:** Compact cortical bone with radiating spicules
- **Chondroblastoma:** Scattered giant cells in a mononuclear cell background with chicken-wire calcification
- **Osteosarcoma:** Pleomorphic spindle cells with osteoid production
- **Parosteal osteosarcoma:** Prominent mature bone formation and low-grade malignant spindle cell tumor

Correct Answer: Interlacing network of bone trabeculae in a loose, vascular, and stromal connective tissue

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3481. (10) Q9-38:

Which of the following statements is true concerning osteoid osteomas of the hands and feet:

1) Swelling, but no pain
3) Lack of surrounding sclerosis about the nidus
2) Marked swelling and synovitis of the adjacent joints
5) Lesions in the feet are twice as common as those in the hand
4) Localization in the phalanges is rare

Osteoid osteomas of the hand and feet can be diagnostic challenges. Prominent new bone formation may be present that makes it difficult to locate the nidus. In contrast, lesions that border articular surfaces may show no reactive sclerosis. CT scans will often show the nidus. There may be marked swelling in superficial lesions and synovitis of adjacent joints.

Important points to remember include:

- The most common location is the phalanges.
- Hand lesions are twice as common as foot lesions.

Correct Answer: Marked swelling and synovitis of the adjacent joints

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3482. (17) Q9-47:

Which of the following tumors has the best prognosis (least risk of pulmonary metastases):

1) Parosteal osteosarcoma
3) Classic (or ordinary) osteosarcoma
2) Periosteal osteosarcoma
5) Osteosarcoma following irradiation
4) Osteosarcoma in Pagetâs disease

Parosteal osteosarcoma is a low-grade form of osteosarcoma. The tumor is well differentiated and has a very low metastatic rate. When local control of the lesion is achieved, the risk of pulmonary metastases is only about 3 to 5%. If the tumor contains areas of high-grade sarcoma (such as high-grade malignant fibrous histiocytoma, fibrosarcoma, or osteosarcoma), the lesion is called a de-differentiated parosteal osteosarcoma. De-differentiated parosteal osteosarcoma has a more ominous prognosis with a high rate of metastases.

The risk of pulmonary metastases for all of the possible answers are as follows:

Tumor	**Approximate Risk**
Periosteal osteosarcoma	20%-30%
Classic (or ordinary) osteosarcoma	80%-90%
Osteosarcoma in Pagetâs disease	80%-90%
Osteosarcoma following irradiation	80%-90%

Correct Answer: Parosteal osteosarcoma

3483. (18) Q9-48:

Which of the following tumors has the best prognosis (least risk of pulmonary metastases):

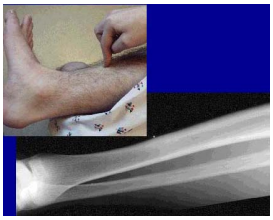
1) Rhabdomyosarcoma
3) Malignant fibrous histiocytoma
2) Primitive neuroectodermal tumor
5) Pleomorphic liposarcoma
4) Myxoid liposarcoma

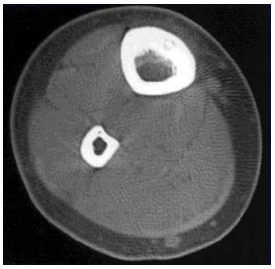
All of the lesions listed in the possible answers are high-grade soft tissue sarcomas, except for myxoid liposarcoma, which is an intermediate-grade sarcoma. Generally, low-, intermediate-, and high-grade sarcomas have the following approximate risk of the patient developing pulmonary metastases:

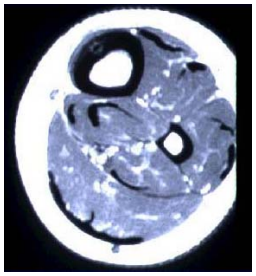
Grade	**Approx. Risk**	**Tumor**
Low (Grade 1)	5%-10%	Grade 1 liposarcoma, Grade malignant fibrous histiocytoma
Intermediate (Grade 2)	20%-30%	Myxoid liposarcoma
High (Grade 3,4)	50%+	Rhabdomyosarcoma, primitive neuroectodermal tumor, malignant fibrous histiocytoma, pleomorphic liposarcoma

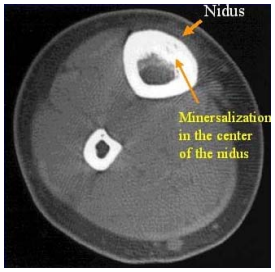
Correct Answer: Myxoid liposarcoma

3484. (19) Q9-54:

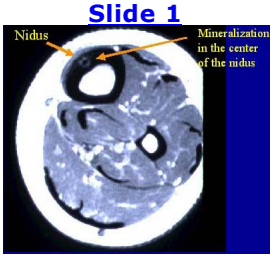








Slide 1 **Slide 2** **Slide 3** **Slide 4**



Slide 5

A 17-year-old boy has a 4-month history of severe pain in his right distal tibia. The pain is especially prominent at night. He has difficulty sleeping and concentrating at school. The lateral radiograph of his right distal tibia and clinical photograph is shown in Figure 1. A computerized tomogram (CT) and axial T1 weighted magnetic resonance imaging (MRI) scan are shown in Figures 2 and 3. The most likely diagnosis is:

1) Osteosarcoma
3) Ewing's tumor
2) Osteomyelitis
5) Stress fracture
4) Osteod osteoma

Osteoid osteomas are common tumors in young individuals. Patients usually present with intense pain and they can often localize the exact point of discomfort.

CT findings are often quite characteristic (Figure 4):

- small nidus 5 mm to 10 mm in the cortex or in a sub-periosteal location
- often there is central ossification in the nidus
- sclerosis surrounding the nidus

On MRI, it is often more difficult to see the nidus than on CT scanning. On T1 weighted images the nidus can often be seen as small round lesion (Figure 5). In the cortex, because the nidus often has mineralization which is low signal (as is the cortex which the nidus is sitting in), one may have trouble detecting the nidus.

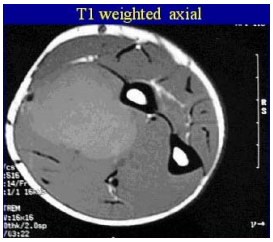
The differential diagnosis of osteod osteomas include:

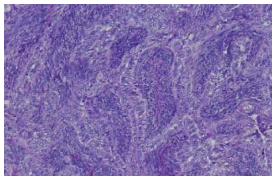
1. Stress fracture
2. Osteomyelitis

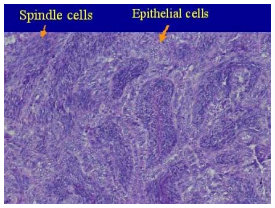
Because of the characteristic imaging findings, one can make this diagnosis based upon the CT or MRI findings.

Correct Answer: Osteod osteoma

3485. (20) Q9-56:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 35-year-old man has a 9-month history of a soft tissue mass in his forearm. The mass has been steadily enlarging over time. The Tl and T2 weighted axial magnetic resonance imaging (MRI) scans are shown in Figures 1 and 2. A biopsy was performed and is shown in Figure 3. The most likely diagnosis is:

1) Malignant fibrous histiocytoma
3) Lipoma
2) Epitheloid sarcoma
5) Synovial sarcoma
4) Desmoid tumor

The forearm mass shown is low signal on TI weighted images and high signal on T2 weighted images. These signal characteristics are non-specific and may represent either a sarcoma or a benign lesion.

The histologic section shows a biphasic lesion with epithelial and spindle cells (Figure 4). This is a typical characteristic of synovial sarcoma.

The histologic appearance of the other lesions is:

malignant fibrous histiocytoma â storiform pattern with pleomorphic spindles cells and histiocytes
epitheloid sarcoma â nodular growth pattern with central necrosis and epithelial quality of the cells
lipoma â mature adipose cells
desmoid - mature spindle cells with abundant collagen and no cellular atypia

Correct Answer: Synovial sarcoma

3486. (21) Q9-57:

Which of the following cartilage tumors has the worst prognosis (highest risk of pulmonary metastases):

1) Chondrosarcoma arising in Ollierâs disease
3) Dedifferentiated chondrosarcoma
2) Chondrosarcoma arising in Maffucciâs syndrome
5) Grade 1 intramedullary chondrosarcoma
4) Grade 2 intramedullary chondrosarcoma

All of the possible answers (except one) are either low- or intermediate-grade bone sarcomas. Dedifferentiated chondrosarcoma is a high-grade spindle cell sarcoma. In dedifferentiated chondrosarcomas, there is a low-grade chondrosarcoma (grade 1 or 2) which is intimately admixed with a high-grade spindle sarcoma (grade 3 or 4 anaplastic spindle cell sarcoma -osteosarcoma, malignant fibrous histiocytoma, or fibrosarcoma).

The risk of pulmonary metastases in the lesions for all of the possible answers are as follows:

Tumor	Approximate Risk
Chondrosarcoma arising in Ollier's disease	1% to 5%
Chondrosarcoma arising in Maffucci's syndrome	1% to 5%
Grade 2 intramedullary chondrosarcoma	20% to 30%
Grade 1 intramedullary chondrosarcoma	1% to 5%

Generally, low-, intermediate-, and high-grade sarcomas have the following risk of systemic metastases:

Grade	Risk
Low (Grade 1)	5% to 10%
Intermediate (Grade 2)	20% to 30%
High (Grade 3,4)	50%+

Correct Answer: Dedifferentiated chondrosarcoma

3487. (23) Q9-59:

Synovial chondromatosis occurs most commonly in which of the following joints:

1) Hip
3) Shoulder
2) Knee
5) Ankle
4) Elbow

Synovial chondromatosis most commonly occurs in the knee. Other joints where it may occur include the hip, ankle, foot, and shoulder.

Correct Answer: Knee

3488. (24) Q9-60:

To which of the following organs do high-grade intramedullary osteosarcomas most commonly metastasize:

1) Brain
3) Adrenals
2) Lungs
5) Kidneys
4) Other bones

Osteosarcomas most commonly spread to the lungs. Plain chest radiographs may not reveal small lesions. Computerized tomography of the chest is the most sensitive method to detect nodules that are 3 mm to 5 mm in diameter. Other sites of metastases include other bones and visceral organs.

Correct Answer: Lungs

3489. (31) Q9-67:

Which of the following benign bone tumors may occasionally (approximately 2% of the time) metastasize to the lungs:

1) Chondromyxoid fibroma
3) Giant cell tumor
2) Osteochondroma
5) Osteofibrous dysplasia
4) Fibrous dysplasia

Giant cell tumor of bone is considered a benign tumor. Occasionally, this tumor can metastasize to the lungs. The incidence in different series has varied between 1% and 9%. Most large series show an incidence of 1% to 2%.

When a giant cell tumor metastasizes to the lungs, the biologic behavior of the lesions can be variable. The overall prognosis is favorable, with 75% to 85% surviving rate. The treatment of the pulmonary metastases depends on the clinical scenario:

- One to five nodules

  Most centers would recommend thoracotomy and removal.

- Greater than 10 nodules

  With large numbers of nodules, there are basically two options -chemotherapy or observation. In some patients, with observation alone, the nodules regress.

  Generally, in approximately 20% of patients, the disease will progress with either enlargement of the pulmonary disease or spread to other organs.

Correct Answer: Giant cell tumor

3490. (32) Q9-69:

Which of the following groups of soft tissue sarcomas commonly metastasize to lymph nodes:

1) Liposarcoma and malignant fibrous histiocytoma
3) Malignant fibrous histiocytoma and clear cell sarcoma
2) Liposarcoma and clear cell sarcoma
5) Malignant fibrous histiocytoma and hemangioendothelioma
4) Synovial sarcoma and epithelioid sarcoma

The four main soft tissue sarcomas that may metastasize to lymph nodes are epithelioid sarcoma, synovial sarcoma, rhabdomyosarcoma and clear cell sarcoma. It is uncommon for the other lesions to metastasize to lymph nodes.

Correct Answer: Synovial sarcoma and epithelioid sarcoma

3491. (34) Q9-71:

Which of the following most commonly occurs in patients with pigmented villonodular synovitis of the knee:

1) Giving way with pivoting
3) Recurrent non-traumatic effusions
2) Pain on ascending and descending steps
5) Medial joint line pain
4) Movie sign (pain following prolonged sitting)

Pigmented villonodular synovitis is a synovial proliferative disorder characterized by atraumatic recurrent effusions and cystic erosions of the periarticular bone surfaces. Patients commonly have multiple knee aspirations with blood-tinged fluid. The effusions are often large.

Correct Answer: Recurrent non-traumatic effusions

3492. (36) Q9-73:

Which of the following best describes the current treatment of osteosarcoma in adolescents:

1) Wide resection alone
3) Wide resection, multi-agent chemotherapy, and radiation
2) Wide resection and multi-agent chemotherapy
5) Interferon and radiation
4) Wide resection and radiation

Osteosarcoma is a high-grade malignant bone tumor. Historical studies have shown that with surgery alone, 80% to 90% of patients develop pulmonary metastases. Multi-agent chemotherapy has dramatically improved long-term survival from 10% to 20% to 60% to 70%.

Currently, the chemotherapy is given for 8 to 12 weeks preoperatively. The tumor is resected and patients are given a 6-month course of maintenance chemotherapy.

Correct Answer: Wide resection and multi-agent chemotherapy

3493. (37) Q9-74:

Which of the following best describes the current treatment of a Grade 2 chondrosarcoma of the distal femur:

1) Wide resection alone
3) Wide resection, multi-agent chemotherapy, and radiation
2) Wide resection and multi-agent chemotherapy
5) Interferon and radiation
4) Wide resection and radiation

Chondrosarcomas are treated by surgical resection alone. Chemotherapy and irradiation play a limited role in treatment. Generally, chondrosarcoma grow slowly, therefore irradiation or chemotherapy will have little effect on the tumor cells.

Correct Answer: Wide resection alone

3494. (38) Q9-75:

Which of the following best describes the current treatment of a parosteal osteosarcoma of the distal femur:

1) Wide resection alone
3) Wide resection, multi-agent chemotherapy, and radiation
2) Wide resection and multi-agent chemotherapy
5) Interferon and radiation
4) Wide resection and radiation

Parosteal osteosarcomas are treated by surgical resection alone. Chemotherapy and irradiation play a limited role in treatment. Parosteal osteosarcomas are composed of two populations of cells â a low-grade spindle cell sarcoma (fibrosarcoma, Grade 1 or 2) and well differentiated osteoblasts that produce large amounts of mature and organized bone. Generally, these cells grow slowly, therefore irradiation or chemotherapy will have little effect on the tumor cells.

In contrast, if there is a dedifferentiated component (a high-grade osteosarcoma, fibrosarcoma, or malignant fibrous histiocytoma), the prognosis is poor with a high risk of pulmonary metastases. In this scenario, the patient would be treated with chemotherapy. There would still be no role for irradiation.

Correct Answer: Wide resection alone

3495. (39) Q9-76:

In which of the following tumors is the bone scan the least sensitive:

1) Metastatic breast cancer
3) Osteosarcoma
2) Metastatic lung cancer
5) Osteoid osteoma
4) Multiple myeloma

The technetium bone scan is sensitive in osteosarcoma and osteoid osteoma because the tumor cells produce osteoid. The technetium isotope localizes well to the sites of osteoid production. In breast cancer, the bone scan is also sensitive as there is often significant amounts of new bone formation. In lung cancer, there is prominent bone destruction. With this bone destruction, there is also some attempt at bone formation and the technetium will localize at these sites. If there is prominent bone destruction with no bone formation, then the bone scan will be negative (false-negative).

With multiple myeloma, there is an uncoupling of the normal relationship between bone resorption and bone formation. In myeloma, the plasma cells secrete a factor that activates and recruits osteoclasts to resorb bone. There is seldom a compensatory formation of bone. This lack of coupling between bone resorption and bone formation leads to the high percentage of false-negatives in patients with multiple myeloma.

Correct Answer: Multiple myeloma

3496. (40) Q9-77:

In patients with destructive lesions secondary to metastatic breast cancer, the cells responsible for the bone destruction are the:

1) Breast cancer cells
3) Osteoclasts
2) Fibroblasts
5) Langerhansâ cells
4) Histiocytes

Interestingly, in metastatic bone disease and multiple myeloma, it is **not** the tumor cells that destroy the bone, but the osteoclasts. The tumor cells secrete a factor that recruits and activates osteoclasts. These osteoclasts then resorb the bone, and the tumor cells grow and fill the holes in the bone.

Correct Answer: Osteoclasts

3497. (41) Q9-78:

The proliferating cell in patients with eosinophilic granuloma is the:

1) Eosinophil
3) Fibroblast
2) Osteoclast
5) Vasoformative cells
4) Langerhansâ cell

Eosinophilic granuloma has been traditionally considered as part of a spectrum of histiocytic disorders called histiocytosis X. This spectrum includes eosinophilic granuloma, Hand-Schüller-Christian Disease and Letterer-Siwe Disease. In recent years, these disorders have been grouped under the single term Langerhans cell granulomatosis. The proliferating cell is not a histiocyte, but rather the dendritic cells, which are named Langerhans' cells. Langerhans cell granulomatosis can be divided into three principal types:

- Single bone involvement (no visceral involvement)
- Multiple bone involvement (no visceral involvement)
- Multiple bone involvement and visceral disease (lung, liver, spleen, lymph nodes, and skin)

Histologically, one may see many eosinophils; however, the proliferating cell is the Langerhans' cell. The Langerhans' cells are characterized by:

- A folded or grooved nucleus
- A sharp nuclear membrane
- Eosinophilic cytoplasm

Correct Answer: Langerhansâ cell

3498. (42) Q9-79:

Which of the following carcinomas has the highest propensity to metastasize to the hand:

1) Prostate
3) Lung
2) Kidney
5) Breast
4) Thyroid

Most carcinomas metastasize to the spine, ribs, pelvis, skull, and proximal limb girdles. It is uncommon for metastases to occur in the hands or feet. A notable exception is lung carcinomas. Lung carcinomas metastasize to the distal skeleton (acral metastases). Over 50% of patients with distal (acral metastases) will have a lung carcinoma as the primary tumor.

Correct Answer: Lung

3499. (43) Q9-80:

What is the most common site of bone metastases:

1) Proximal femur
3) Pelvis
2) Proximal humerus
5) Hands/feet
4) Spine

Bone metastases most commonly occur in the axial skeleton, with the vertebral bodies as the most common site. The common distribution is to:

- Spine
- Ribs
- Pelvis
- Skull
- Proximal long bones

Lesions in the hands and feet are uncommon. When these distal metastases do occur, approximately one-half will be secondary to lung cancers.

Correct Answer: Spine

3500. (44) Q9-81:

Hypercalcemia commonly occurs in which of the following bone lesions:

1) Osteosarcoma
3) Malignant fibrous histiocytoma
2) Multiple myeloma
5) Hemangioendothelioma
4) Chondrosarcoma

Serum hypercalcemia is a common problem in cancer patients. The most common cancers in which this complication may occur include:

- Multiple myeloma
- Lymphoma
- Metastatic lung cancer
- Metastatic breast cancer

The symptoms of hypercalcemia include:

Acute	Chronic
Anorexia	Visual changes
Constipation	Coma
Polyuria/polydipsia	
Nausea/vomiting	
Lethargy	
Inability to concentrate	
Need for more sleep	

The treatment of hypercalcemia is threefold:

- Hydration
- Saline diuresis
- Diphosphonates: Intravenous pamidronate can correct the hypercalcemia within 48 hours

Correct Answer: Multiple myeloma

3501. (45) Q9-82:

Which of the following lesions often involves multiple bones in the same extremity in young patients:

1) Osteosarcoma
3) Chondroblastoma
2) Giant cell tumor
5) Chondromyxoid fibroma
4) Hemangioendothelioma

Most bone tumors are solitary lesions with a low incidence of multicentricity. Vascular tumors are an exception. These tumors may involve multiple bones. Patients with hemangioendothelioma present with multiple lytic lesions. These lytic lesions often occur in the same extremity in young patients.

Correct Answer: Hemangioendothelioma

3502. (46) Q9-83:

In a patient with Pagetâs disease, which of the following serum laboratory tests will most likely be abnormal:

1) Serum calcium
3) Serum erythrocyte sedimentation rate
2) Serum protein electrophoresis
5) Serum alkaline phosphatase
4) Serum phosphate

Serum alkaline phosphatase levels will be abnormal in approximately 96% of patients. The elevations vary from mild to profound. Despite the extensive bone turnover, the serum calcium levels are normal. If the serum calcium level is elevated, one should look for other conditions such as primary hyperparathyroidism.

The serum calcium level and erythrocyte sedimentation rate may be elevated in patients with multiple myeloma. The serum protein electrophoresis will show a monoclonal spike in patients with multiple myeloma.

Correct Answer: Serum alkaline phosphatase

3503. (47) Q9-84:

In evaluating the radiographs of a patient with Pagetâs disease, which of the following would be suggestive of malignant change:

1) Enlargement of the bone
3) Marked bowing
2) Coarsened trabeculae
5) Cortical bone destruction
4) Multiple lucent areas

Pagetâs disease is a remodeling disease in which the normal cortices are resorbed and replaced with remodeled cortices. In this condition, there are coarsened trabeculae, lucent areas, and bone enlargement. Bowing may occur and varies from mild to marked.

Cortical bone destruction and the presence of a soft tissue mass are common findings in patients where Pagetâs disease has undergone malignant change. Both MRI and CT scans are excellent modalities to detect malignant change. As the remodeling occurs, there should not be any destruction of the cortical bone.

Correct Answer: Cortical bone destruction

3504. (48) Q9-85:

Which of the following benign bone lesions is the most likely to recur following curettage:

1) Chondroblastoma
3) Non-ossifying fibroma
2) Enchondroma
5) Giant cell tumor
4) Osteoid osteoma

Of all the benign tumors listed in the possible answers, giant cell tumors are the most prone to recur locally. Historical studies have shown local failure rates as high as 30% to 40% following curettage and grafting. The most modern technique employs curettage and reconstruction with methyl methacrylate. The local failure rate with this technique is 5% to 20%. Some centers also use adjuvants such as phenol, liquid nitrogen, and hydrogen peroxide.

The other lesions have low rates of recurrance:

- Chondroblastoma 5%-10%
- Enchondroma <5%
- Non-ossifying fibroma <5%
- Osteoid osteoma <5%

Correct Answer: Giant cell tumor

3505. (49) Q9-86:

Which of the following descriptions would apply to the radiographic findings in a patient with adamantinoma:

1) Multiple poorly demarcated lytic lesions (>5)
3) Eccentric, cortically based lytic lesion with a well-formed sclerotic rim
2) Eccentric, lytic, expansile lesion in the proximal tibial metaphysis
5) Central medullary mineralized lesion with rings and stipples; no cortical abnormalities
4) Multiple lucencies in the tibial diaphysis with sclerosis of the intervening bone

Adamantinoma is a peculiar and rare bone tumor that almost exclusively involves the tibia. In some cases, when adamantinoma occurs in the tibia and fibula, there are multicentric lesions. If one finds multiple bone involvement (sites other than the tibia and fibula), the diagnosis of adamantinoma is unlikely.

The radiographic appearance is quite characteristic. The most common appearance is mixed sclerotic and lytic lesions. Often, one will find multiple lucencies with intervening sclerosis of the bone. Seventy percent of the lesions involve the mid-shaft of the tibia, with the remaining lesions involving the proximal or distal tibia.

The other possible answers describe other bone lesions:

Aneurysmal bone cyst:	An eccentric, lytic, expansile lesion in the proximal tibial metaphysis.
Non-ossifying fibroma:	An eccentric, cortically based lytic lesion with a well-formed sclerotic rim.
Enchondroma:	A central medullary mineralized lesion with rings and stipples that has no cortical abnormalities.

Correct Answer: Multiple lucencies in the tibial diaphysis with sclerosis of the intervening bone

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3506. (50) Q9-87:

Which of the following histologic descriptions is typical of adamantinoma of long bones:

1) A mixed pattern of inflammatory cells, edema, and new blood vessels
3) Spindle cells and immature bone trabeculae
2) Langerhans' cells and eosinophils
5) Uniform population of small blue cells
4) Epithelial cells in a fibrous background

There are several different histologic patterns for adamantinoma: basaloid, spindle, tubular, squamoid, and osteofibrous-dysplasia like. Each of these patterns shares the basic finding of epithelial cells in a fibrous background.

The other possible answers describe various bone lesions:

Osteomyelitis:	A mixed pattern of inflammatory cells, edema, and new blood vessels
Eosinophilic granuloma:	Langerhans' cells and eosinophils
Fibrous dysplasia:	Spindle cells and immature bone trabeculae
Ewing's tumor:	Uniform population of small blue cells

Correct Answer: Epithelial cells in a fibrous background

3507. (52) Q9-89:

The most common early symptom of a sacrococcygeal chordoma is:

1) Pelvic pain
3) Sacral nerve dysfunction
2) Obstipation
5) Easy fatigability
4) Urinary hesitancy

Pelvic pain is the most common early symptom in patients with chordomas. As the mass grows anteriorly and through the sacral foramina, a constellation of symptoms may occur. Late findings may include:

- Obstipation secondary to obstruction of the rectum
- Sacral nerve dysfunction

Correct Answer: Pelvic pain

3508. (54) Q9-91:

Which of the following describes the histologic appearance of a chordoma:

1) Uniform population of small blue cells
3) Sheets of plasma cells
2) Pleomorphic spindles cells that directly produce bone
5) A mixture of inflammatory cells, new blood vessels, and edema
4) Cords or nest of cells with a vacuolated cytoplasm in a myxoid intercellular matrix

Chordomas have a characteristic appearance:

- Cords or nests of solid cells that have a vacuolated cytoplasm embedded in a myxoid intercellular matrix

The other possible answers describe specific lesions:

Ewing's tumor:	Uniform population of small blue cells
Osteosarcoma:	Pleomorphic spindle cells that produce bone
Myeloma:	Sheets of plasma cells
Osteomyelitis:	A combination of mixed inflammatory cells, edema, and new blood vessels

Correct Answer: Cords or nest of cells with a vacuolated cytoplasm in a myxoid intercellular matrix

3509. (55) Q9-92:

The most common radiographic appearance of a chordoma is:

1) Marked sclerosis
3) Purely lytic with scattered calcific densities
2) Mixed lytic-sclerosis
5) Vertebral collapse with flattening and widening
4) Marked cortical thickening with coarsened trabeculae

Chordomas most commonly have a purely lytic appearance. Occasionally, they may be purely sclerotic or have a mixed appearance of lytic-sclerosis.

In the sacrococcygeal area, chordomas are typically purely lytic. The tumor grows anteriorly and expands centripetally with a periosteal layer. The soft tissue mass often has calcific densities scattered throughout. These calcifications are usually mild to moderate.

Correct Answer: Purely lytic with scattered calcific densities

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3510. (56) Q9-93:

Which of the following describes the histologic features of conventional chordoma:

1) Physaliferous cells and high-grade pleomorphic spindle cells
3) Uniform population of small blue cells
2) Lobular growth pattern and physaliferous cells
5) Sheets of cells with eccentric nucleus and peripheral nuclear chromatin pattern
4) Organoid pattern of epithelial cells in a fibrous background

The principal histologic features of conventional chordomas are:

- Lobular growth pattern
- Nests of solid cells with a vacuolated cytoplasm
- Physaliferous cells

Dedifferentiated chordomas have the typical features: lobular growth pattern, physaliferous cells, and a myxoid background. The other answers describe specific tumors:

- Uniform population of small blue cells â Ewings tumor
- Organized pattern of epithelial cells in a fibrous background â Metatastic carcinoma
- Sheets of cells with eccentric nucleus, peripheral chromatin pattern â Myeloma

Correct Answer: Lobular growth pattern and physaliferous cells

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3511. (59) Q9-96:

A 15-year-old male has an eccentric, destructive lesion in the distal femoral metaphysis that is purely lytic and extends into the soft tissue. The cortex overlying the lesion has been destroyed, but there is a thin rim of periosteal bone that is continuous. Based on the radiographic findings, the most likely diagnosis is:

1) Chondroblastoma
3) Osteoid osteoma
2) Osteochondroma
5) Chondrosarcoma
4) Aneurysmal bone cyst

The radiographic features of aneurysmal bone cyst are:

- Expansile, lytic lesion that destroys the cortex
- Purely lytic
- Continuous rim of periosteal bone over the lesion

The radiographic features of the other lesions are:

Chondroblastoma:	Lytic lesion in the epiphysis Sclerotic rim surrounding the lesion One-third of the radiographs have matrix mineralization
Osteochondroma:	Surface lesion with cortical sharing Medullary cavity of the osteochondroma is continuous with the host bone Metaphyseal based Point away from the joint
Osteoid osteoma:	Small lytic nidus (5 mm-10 mm) Nidus is surrounded by sclerotic bone
Chondrosarcoma:	Large lesions with cortical changes: Cortical thickening Large cortical erosions Cortical breakthrough

Correct Answer: Aneurysmal bone cyst

3512. (61) Q9-98:

All of the following statements are true concerning osteoblastomas except:

1) They may grow to large size
3) Surrounding sclerosis may be minimal or absent
2) There is often a lack of nocturnal pain that is responsive to aspirin
5) Histologically, osteoblastoma is similar to osteoid osteoma
4) The lesion is usually 5 mm to 10 mm in diameter

In contrast to osteoid osteomas, which have a limited growth potential (5 mm to 10 mm, occasionally 10 mm to 15 mm), osteoblastomas may grow to large size. When they occur in the spine, osteoblastomas may press on the spinal cord and nerve roots causing neurologic symptoms and even deficits.

Histologically, osteoblastomas are similar to osteoid osteomas.

Osteoblastomas differ from osteoid osteomas in that:

- There is often a lack of nocturnal pain that is responsive to aspirin
- Surrounding sclerosis may be minimal or absent

Correct Answer: The lesion is usually 5 mm to 10 mm in diameter

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3513. (62) Q9-99:

Forty percent of osteoblastomas involve the axial skeleton. Which of the following statements is true:

1) The vertebral body is the most common location.
3) The presence of aneurysmal bone cyst changes within the lesion is rare.
2) The posterior elements are the most common site.
5) Patients are generally over 50 years of age.
4) Neurologic symptoms are unusual.

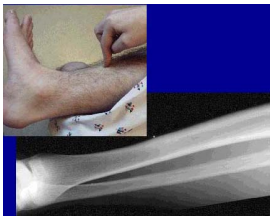
Osteoblastomas commonly occur in the spine. The lesions involve the posterior elements, may cause neurologic symptoms, and commonly occur in young patients.

The following statements are true concerning osteoblastomas of the spine:

- Posterior elements are the most common site.
- Neurologic symptoms are common.
- Expansion of the posterior elements is common.
- Aneurysmal bone cyst-like changes are commonly seen histologically.
- The patients are generally young.

Correct Answer: The posterior elements are the most common site.

3514. (63) Q9-101:



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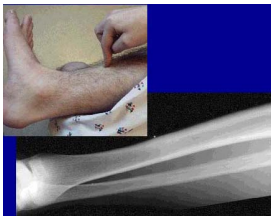

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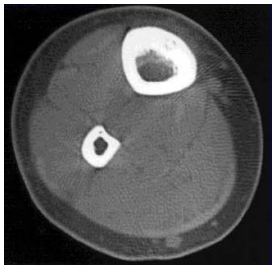

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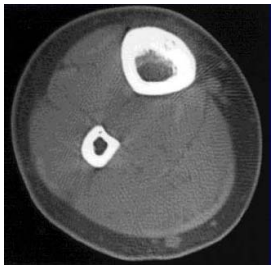

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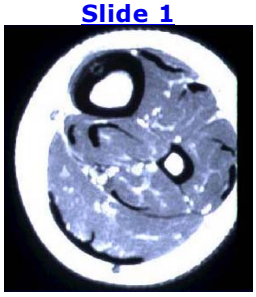

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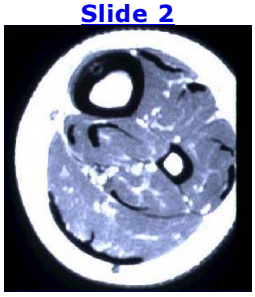


Slide 6

A 17-year-old man has a 4-month history of severe pain in his right distal tibia. The pain is especially prominent at night. He has difficulty sleeping and concentrating at school. The lateral radiograph of his right distal tibia and clinical photograph is shown in Figure 1. A CT and axial T1-weighted MRI scan are shown in Figures 2 and 3. Which of the following historical findings would help in establishing the diagnosis:

1) Pain that occurs only with activity
3) Morning stiffness
2) Pain that occurs after running 2 to 3 miles
5) Pain on the sole of his foot associated with his first step in the morning
4) Complete resolution of the pain with aspirin or ibuprofen

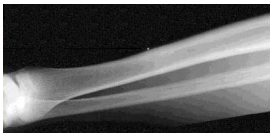
Patients with osteoid osteomas have a characteristic pain pattern. Often, osteoid osteoma pain is completely relieved by aspirin or nonsteroidal anti-inflammatory drugs (NSAIDs). Children may finish an entire bottle of ibuprofen in just 1 week in order to avoid the pain.

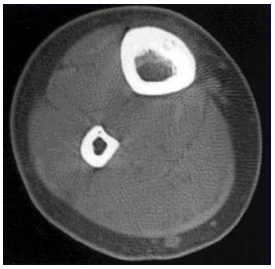
The other possible answers describe common symptoms of other musculoskeletal conditions:

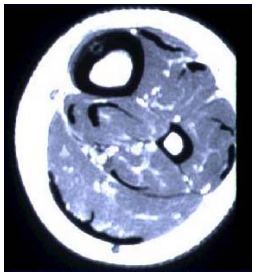
Stress fractures:	Pain only with activity
Exertional compartment syndrome:	Morning stiffness; inflammatory arthritis
Ankylosing spondylitis or rheumatoid arthritis:	Pain that occurs after running 2 to 3 miles
Planter fascitis:	Pain with the first step in the morning on the sole of the foot

Correct Answer: Complete resolution of the pain with aspirin or ibuprofen

3515. (64) Q9-102:







Slide 1 **Slide 2** **Slide 3**

A 17-year-old man has a 4-month history of severe pain in his right distal tibia. The pain is especially prominent at night. He has difficulty sleeping and concentrating at school. The lateral radiograph of his right distal tibia is shown in Figure 1. A CT and axial T1-weighted MRI scan are shown in Figures 2 and 3. Which of the following treatment options should be recommended to the patient and family:

1) Open or needle biopsy, preoperative chemotherapy, and wide resection
3) Below knee amputation
2) Open or needle biopsy, preoperative chemotherapy, and external beam irradiation
5) Nonsteroidal anti-inflammatory medications
4) Long leg cast for 4 weeks, followed by a patellar tendon bearing cast

In this case, the diagnosis is osteoid osteoma. Osteoid osteomas are common tumors in young individuals. Patients usually present with intense pain, and they can often localize the exact point of discomfort.

CT findings are often characteristic:

- A small nidus, 5 mm to 10 mm, in the cortex or in a sub-periosteal location
- Central ossification is often present in the nidus
- Sclerosis is found surrounding the nidus

The pain of osteoid osteomas is often dramatically relieved by aspirin or nonsteroidal anti-inflammatory drugs (NSAIDs). Kniesel and Simon reported on a series of patients treated with NSAIDs in the Journal of Bone and Joint Surgery. Approximately 50% of the patients had long-term relief of their pain.

Correct Answer: Nonsteroidal anti-inflammatory medications

3516. (65) Q9-103:

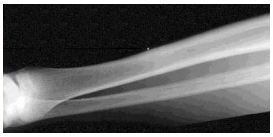


Figure 1

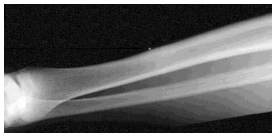


Figure 1

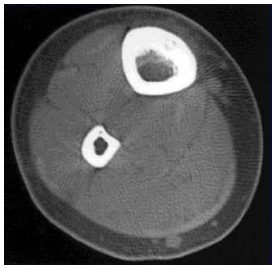


Figure 2

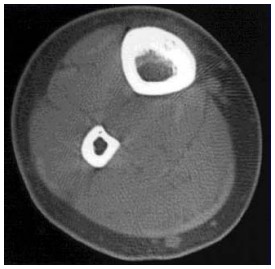


Figure 2

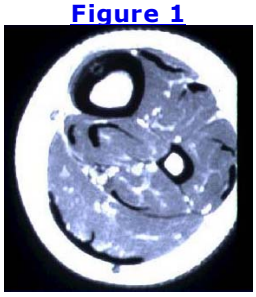


Figure 3

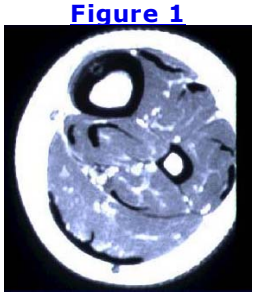


Figure 3

A 17-year-old man has a 4-month history of severe pain in his right distal tibia. The pain is especially prominent at night. He has difficulty sleeping and concentrating at school. The lateral radiograph of his right distal tibia is shown in Figure 1. A CT and axial T1-weighted MRI scan are shown in Figures 2 and 3. The stage of this tumor according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage III
4) Stage II

From the information provided in the question:

- The lesion is symptomatic.
- The CT and MRI scan are diagnostic of an osteoid osteoma.

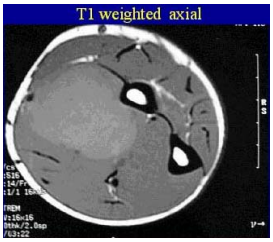
Although osteoid osteomas may cause severe pain, they do not grow and destroy bone structure. Accordingly, this lesion is an active benign lesion - Stage 2.

The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for benign lesions is divided into three groups: inactive (latent), active, and aggressive.

Inactive (latent) Stage 1	Refers to lesions that are not causing pain and show no evidence of active growth. Stage 1 lesions are generally treated with observation only.
Active Stage 2	Refers to lesions which are causing pain or some form of disability. If a lesion has weakened the structure of the bone such that fracture may occur, the lesion would also be considered a Stage 2 lesion.
Aggressive Stage 3	Refers to lesions which are large, have broken into the soft tissues, or have caused a pathologic fracture. These lesions are usually prone to local recurrence and have the potential of causing a major problem for the patient.

Correct Answer: Stage 2

3517. (66) Q9-105:



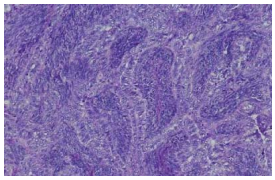


Figure 1 **Figure 2** **Figure 3**

A 35-year-old man has a 9-month history of a soft tissue mass in his forearm. The mass has been steadily enlarging over time. The T1- and T2-weighted axial MRI scans are shown in Figures 1 and 2, respectively. A biopsy was performed and is shown in Figure 3. The most appropriate treatment of this mass would be:

1) Observation
3) Preoperative radiation therapy and wide resection
2) Simple excision
5) External beam irradiation and chemotherapy
4) External beam irradiation alone

The radiographic appearance of the lesion, low signal on T1-weighted images and high signal on T2-weighted images, is nonspecific. Virtually all sarcomas are low signal on T1-weighted images and high signal on T2-weighted images. However, one must remember that not all lesions that are low on T1-weighted images and high on T2-weighted images are malignant.

The histologic section shows a bimorphic tumor with both spindle cells and epithelial cells. This is the classic appearance of synovial sarcoma. This lesion is a high-grade malignancy and would be treated with preoperative irradiation and wide resection. Other acceptable answers are:

- Wide resection and postoperative radiation
- Preoperative chemotherapy, radiation therapy, and wide resection

High-grade sarcomas cannot be cured without surgery, hence the possible answers listed that do not include surgery are wrong. Simple excision would result in prompt local recurrence as the margins would be positive. Observation is a poor choice, as the tumor would continue to grow and probably metastasize.

Correct Answer: Preoperative radiation therapy and wide resection

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3518. (78) Q9-122:

Which of the following variables is a significant risk factor for distant metastases in patients with soft tissue sarcomas:

1) Age
3) Size
2) Sex
5) Presence of pain
4) Location

Size and grade are probably the 2 most significant factors that predict the risk of metastases. A recent study reported the correlation between size and distant metastases:

Size	Risk of distant metastases
1 cm-5 cm	20%
6 cm-10 cm	41%
11 cm-15 cm	53%

Correct Answer: Size

3519. (79) Q9-123:

Which of the following soft tissue sarcomas most commonly occurs in children younger than 10 years old:

1) Malignant fibrous histiocytoma
3) Synovial sarcoma
2) Fibrosarcoma
5) Epithelioid sarcoma
4) Rhabdomyosarcoma

Rhabdomyosarcoma is the most common soft tissue sarcoma in children younger than 10 years old. The most malignant subtype of rhabdomyosarcoma, alveolar rhabdomyosarcoma, occurs in the trunk and extremities.

Correct Answer: Rhabdomyosarcoma

3520. (80) Q9-124:

Which of the following soft tissue sarcomas is the most responsive to chemotherapy:

1) Malignant fibrous histiocytoma
3) Synovial sarcoma
2) Fibrosarcoma
5) Epithelioid sarcoma
4) Rhabdomyosarcoma

Rhabdomyosarcoma is the most common soft tissue sarcoma in children. Rhabdomyosarcoma is very sensitive to both chemotherapy and radiation. Long-term survival in children who present with localized disease is 60% to 70%.

Correct Answer: Rhabdomyosarcoma

3521. (81) Q9-125:

Which of the following agents decreases the rate of skeletal complications and delays the time of the first skeletal complication in patients with metastatic breast cancer:

1) Calcitonin
3) Aredia (pamidronate disodium, Novartis)
2) Taxol (paclitaxel, Bristol-Myers Squibb)
5) Zofran (ondansetron, Glaxo Wellcome)
4) Adriamycin (adrenocorticotropic hormone, Pharmacia & Upjohn)

Pamidronate is a disphosphonate that is highly effective in stopping osteoclastic bone resorption in patients with metastatic breast cancer. A randomized study showed that intravenous pamidronate (90 mg monthly for 12 months) lowered the rate of skeletal complications and delayed the median time for the first skeletal complication from 7.0 to 13.1 months. Virtually all patients with bone metastases and breast cancer now receive intravenous pamidronate.

- Calcitonin â used as an anti-resorptive agent in patients with Pagets disease
- Taxol â used as an anti-estrogen agent in patients with breast cancer
- Adriamycin â used as a cytotoxic chemotherapy agent
- Zofran â used as an anti-nausea agent

Correct Answer: Aredia (pamidronate disodium, Novartis)

3522. (82) Q9-126:

Which of the following cell types is directly responsible for the resorption of bone in patients with metastatic breast carcinoma:

1) Breast carcinoma cells
3) Osteoblasts
2) Osteocytes
5) C cells of the parathyroid glands
4) Osteoclasts

Bone resorption in metastatic breast cancer is directly caused by osteoclasts. The tumor cells secrete a factor that activates the osteoclasts, which then resorb the bone mineral.

Factors implicated in tumor mediated bone resorption include:

- Parathyroid related protein (PTHrP)
- Interleukins 1 and 6
- Tumor necrosis factor alpha

Correct Answer: Osteoclasts

3523. (83) Q9-127:

Which of the following groups of carcinomas have the highest risk for metastases to bone:

1) Lung, breast, kidney, and prostate
3) Lung, breast, gastric, and cervix
2) Lung, gastric, rectal, and sweat gland
5) Breast, ovarian, prostate, and esophagus
4) Lung, prostate, cervix, and ovarian

There are approximately 1.4 million new cancer cases in the United States each year. Of these cases, the most common carcinomas to metastasize to bone are: lung, breast, prostate, and kidney.

Virtually any malignancy can metastasize to bone, but not as commonly as the 'big four':

- **Lung**
- **Breast**
- **Prostate**
- **Kidney**

Correct Answer: Lung, breast, kidney, and prostate

3524. (84) Q9-128:

Allografts are commonly used to reconstruct large segment defects following the resection of tumors. Non-union of the allograft-host junction occurs in approximately what percentage of patients:

1) 1% to 2%
3) 15% to 35%
2) 5% to 10%
5) 75% to 90%
4) 50% to 60%

Allografts and custom prostheses are the 2 major methods to reconstruct defects following resection of bone tumors. The major complications following allograft reconstruction include: infection, fracture, breakdown of the articular cartilage, and non-union.

Non-union of the allograft host junction occurs in about 17% to 33% of patients. The non-union risk is greater when chemotherapy or radiation is needed. Diaphysis to diaphysis junctions are the unions that are the most difficult to unite.

Correct Answer: 15% to 35%

3525. (85) Q9-129:

Allografts are commonly used to reconstruct large segment defects. The rate of deep infection following allograft reconstruction is:

1) 1% to 2%
3) 10% to 15%
2) 2% to 5%
5) 50% to 75%
4) 25% to 50%

Allografts and custom prostheses are the 2 major methods to reconstruct defects following resection of bone tumors. The major complications following allograft reconstruction include: infection, fracture, breakdown of the articular cartilage, and non-union.

Infection is the most devastating complication and occurs in about 10% to 15% of patients.

Correct Answer: 10% to 15%

3526. (86) Q9-130:

Which of the following agents is used to protect against hemorrhagic cystitis that occurs following chemotherapeutic treatment with ifosfamide or cyclophosphamide:

1) Leucovorin
3) 2-mercaptoethanesulfonate (MESNA)
2) Granulocyte colony-stimulating factor
5) Amifostine (Ethoyl)
4) Ondansetron (Zofran)

Hemorrhagic cystitis is a severe complication associated with ifosfamide and cyclophosphamide treatment. Both of these agents are used in regimens for osteosarcoma. These agents produce an acrolein metabolite that causes acute sterile hemorrhagic cystitis. 2-mercaptoethanesulfonate (MESNA) neutralizes this compound and prevents the cystitis.

The other possible answers are also used to ameliorate the side effects of chemotherapy:

Leucovorin (folic acid):	Rescue cells following high dose methotrexate (folic acid analog that does not require reduction by the enzyme dihydrofolate reductase, bypasses effects of methotrexate)
Granulocyte-colony stimulating factor:	Reduces the duration of neutropenia following chemotherapy
Ondansetron (Zofran):	Prevents nausea
Amifostine:	Protects against cisplatin toxicity (mucositis, esophagitis)

Correct Answer: 2-mercaptoethanesulfonate (MESNA)

3527. (87) Q9-131:

Which of the following chemotherapeutic agents is the most important in the treatment of patients with osteosarcoma:

1) Cyclophosphamide
3) Adriamycin
2) Cisplatin
5) Methotrexate
4) Vincristine

Virtually all chemotherapeutic regimens for the treatment of osteosarcoma utilize multidrug combinations. The dose intensity of methotrexate has been found to be the most important factor in disease-free survival.

The most common agents are:

- Cyclophosphamide
- Ifosfamide
- Cisplatin
- Adriamycin
- Actinomycin D
- Bleomycin
- Vincristine
- Etoposide
- Methotrexate

Correct Answer: Methotrexate

3528. (88) Q9-132:

Which of the following describes the histologic appearance of osteoblastoma:

1) Osteoblastomas have a high mitotic rate with atypical mitoses
3) There is a lack of rimming osteoblasts on the bone trabeculae
2) Osteoblastomas show an interlacing network of trabeculae in a loose fibrovascular stroma with prominent vasculature
5) Lace-like osteoid is prominent
4) Multi-nucleated giant cells are a rare finding

Osteoblastomas have a characteristic histologic appearance that is best described as an interlacing network of bone trabeculae in a loose fibrovascular stroma with prominent vasculature.

Other important features to remember are:

- Presence of rimming osteoblasts
- Multi-nucleated giant cells are common.

To help differentiate osteoblastoma from malignant lesions, one should remember that:

- Lace-like osteoid production, which is common in osteosarcomas, is generally not found in osteoblastomas.
- The nuclei lack pleomorphism.
- Atypical mitoses are not present.

Correct Answer: Osteoblastomas show an interlacing network of trabeculae in a loose fibrovascular stroma with prominent vasculature

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3529. (89) Q9-133:

Which of the following tumors has been associated with a chromosomal translocation from chromosome 9 to 22:

1) Malignant fibrous histiocytoma
3) Parosteal osteosarcoma
2) Fibrosarcoma
5) Periosteal osteosarcoma
4) Extra-skeletal myxoid chondrosarcoma

Recently, 2 cartilage tumors have been associated with genetic abnormalities:
Extra-skeletal myxoid chondrosarcoma: Translocation from chromosome 9 to 22
Multiple exostoses: Exostosis genes:
EXT 1 chromosome 8 (8q24)
EXT 2 chromosome 11 (11p13)
EXT 3 chromosome 19 (19q)

Correct Answer: Extra-skeletal myxoid chondrosarcoma

3530. (90) Q9-134:

Microscopically, aggressive osteoblastomas are similar to conventional osteoblastomas. Which of the following histologic findings distinguishes aggressive osteoblastomas from conventional osteoblastomas:

1) Prominent vasculature
3) Epithelioid osteoblasts
2) Loose fibrovascular stroma
5) Peripheral shell of reactive bone bordering soft tissue extension
4) Irregular network of interlacing bone trabeculae

'Aggressive osteoblastoma' is a term used to describe osteoblastomas that tend to behave in a more locally aggressive fashion than conventional osteoblastomas. One must remember that 'aggressive osteoblastomas' are still benign lesions and do not metastasize.

Histologically, one distinguishes 'conventional osteoblastoma' from 'aggressive osteoblastoma' by the presence of epithelioid osteoblasts. These are plump, round to oval osteoblasts that have a peri-nuclear halo, which is similar to plasma cells.

The other features listed as possible answers are common characteristics found in both forms of osteoblastoma:

- Prominent vasculature
- Loose fibrovascular stroma
- Irregular network of interlacing bone trabeculae
- Peripheral shell of reactive bone bordering soft tissue extension

Correct Answer: Epithelioid osteoblasts

3531. (91) Q9-135:

Osteosarcoma occurs most commonly in which of the following bones:

1) Distal femoral metaphysis and proximal humeral metaphysis
3) Distal femoral metaphysis and distal radial metaphysis
2) Distal femoral metaphysis and proximal tibial metaphysis
5) Proximal tibial metaphysis and proximal humeral metaphysis
4) Distal femoral metaphysis and ilium

Osteosarcoma most commonly occurs about the knee. The distal femur is the most common site followed by the proximal tibia. These two growth plates account for the majority of the growth in the lower extremity.

In order of frequency, other common sites include:

- Proximal humerus
- Ilium
- Proximal femur
- Distal tibia

Correct Answer: Distal femoral metaphysis and proximal tibial metaphysis

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3532. (92) Q9-137:

Which of the following cartilage tumors has the worst prognosis in regard to survival:

1) Grade II chondrosarcoma of the proximal femur
3) Grade 2 chondrosarcoma of the distal femur
2) Grade I chondrosarcoma of the pelvis
5) Grade I chondrosarcoma arising in a pelvic osteochondroma
4) Dedifferentiated chondrosarcoma of the distal femur

In cartilage tumors, the histologic grade of the lesion is the most important determinate of long-term disease-free survival. Grade I chondrosarcomas seldom, if ever, metastasize. In contrast, dedifferentiated chondrosarcomas metastasize in 75% to 90% of cases.

A study of 67 pelvic chondrosarcomas showed the following rate of metastases:

	Approximate Rate of Metastases
Grade I	0%
Grade II	20%
Grade III	60%
Dedifferentiated	75%

Correct Answer: Dedifferentiated chondrosarcoma of the distal femur

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3533. (93) Q9-138:

Chondrosarcoma rarely occurs in which of the following locations:

1) Pelvis
3) Proximal femur
2) Proximal humerus
5) Carpal bones and phalanges
4) Distal femur

Chondrosarcomas are common in the pelvis, proximal humerus, and proximal and distal femur. In contrast, chondrosarcomas rarely occur in the hands and feet.

Interestingly, although chondrosarcomas are rare in the hands and feet, the histologic appearance of enchondromas of the hands and feet can be worrisome. Cellular atypia is often accepted in the hands and feet and still classified as a benign enchondroma. However, the same histology in a pelvic or femoral location would be consistent with a medium or high-grade chondrosarcoma.

Correct Answer: Carpal bones and phalanges

3534. (94) Q9-139:

Which of the following pairs of tumors are related as they share a chromosomal translocation between chromosome 11 and chromosome 22 (t [11;22]):

1) Chondrosarcoma and osteosarcoma
3) Adamantinoma and osteofibrous dysplasia
2) Malignant fibrous histiocytoma and fibrosarcoma
5) Osteoid osteoma and osteoblastoma
4) Ewingâs tumor and primitive neuroectodermal tumor

Ewingâs tumor and primitive neuroectodermal tumor are related as they share a chromosomal translocation between chromosome 11 and chromosome 22 (t [11;22]). A chimeric protein is produced that appears to act as transcriptional activator. This translocation is found in 95% of these tumors.

Correct Answer: Ewingâs tumor and primitive neuroectodermal tumor

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3535. (95) Q9-140:

Which of the following factors is a poor prognostic variable in patients with high-grade intra-medullary osteosarcoma:

1) Distal femoral location
3) Elevated alkaline phosphatase level
2) Soft tissue extension
5) Male sex
4) Expression of multidrug resistance gene

The expression of the multidrug resistance (MDR) gene has been shown to be an adverse survival factor in several studies. MDR-1 codes for p-glycoprotein, a calcium-dependent adenosine triphosphatase, located on the cell membrane. This protein has the ability to pump chemotherapeutic agents out of the cell (especially adriamycin). In a recent study, the presence of this glycoprotein increased the risk of a poor survival in patients by over 3 times. P-glycoprotein has been found in up to 25% of primary tumors and 50% of metastatic tumors.

Correct Answer: Expression of multidrug resistance gene

3536. (96) Q9-141:

Metastases are common in patients with high-grade intramedullary osteosarcoma. The most common sites of metastases are:

1) Lungs and lymph nodes
3) Lungs and bone
2) Lungs and liver
5) Lungs and kidney
4) Lungs and brain

Patients with high-grade intramedullary osteosarcoma have a high rate of metastases to the lungs (90%) and bone (20%). Approximately 10% to 20% of patients present with metastatic disease in the lungs or bone (Musculoskeletal Tumor Society Stage III).

Patients who have negative staging studies (normal technetium bone scan and CT scan of the chest) still have an incidence of 80% to 90% of occult metastases. In the pre-chemotherapy era, the survival in patients with osteosarcoma was only 10% to 20% because there was no method of killing the occult metastases. Now with multi-agent chemotherapy that is delivered pre- and postoperatively, we are able to save over 60% of these patients.

Correct Answer: Lungs and bone

3537. (97) Q9-142:

The risk of developing a sarcoma in an enchondroma or an osteochondroma is approximately:

1) Less than 1%
3) 5% to 10%
2) 3% to 5%
5) 15% to 20%
4) 10% to 15%

Enchondromas and osteochondromas are the most common benign tumors of the skeleton. The risk of developing a sarcoma within an enchondroma or an osteochondroma is *extremely low.* The incidence is far below 1%.

Correct Answer: Less than 1%

3538. (98) Q9-143:

Giant cell tumor of bone is very prone to local recurrence following curettage. What is the approximate local recurrence rate following curettage and methyl methacrylate augmentation:

1) 1%
3) 8% to 25 %
2) Less than 5 %
5) 50% to 75 %
4) 25% to 50%

Giant cell tumor of bone is very prone to local recurrence. Historically, series in which the tumor was removed by curettage and then the defect reconstructed with methyl methacrylate has local failure rates as high as 40% to 50%. Because of the high recurrence rate, some surgeons advocated resection and reconstruction with allografts or prosthetic devices, especially for recurrent tumors.

A new treatment method has been developed that is an extended form of curettage. The principles of treatment are as follows:

- Wide exteriorization: Removal of the cortex over the lesion
- Curettage with hand curettes
- Curettage with a power burr
- Adjuvant cauterization with one of the following: Phenol, hydrogen peroxide, or liquid nitrogen
- Reconstruction of the subchondral surface with autogenous bone graft
- Methyl methacrylate reconstruction of the defect
- Internal fixation as necessary: Either Steinmann pins inside the medullary cavity or plate fixation

The local recurrence rate in 2 recent series with this technique was 8% (3 of 38) and 25% (15 of 60).

Correct Answer: 8% to 25 %

3539. (99) Q9-144:

Which of the following radiographic features helps to distinguish aneurysmal bone cyst from unicameral bone cyst:

1) Purely lytic appearance
3) Frequently borders the growth plate
2) Frequently metaphyseal
5) Expansion of the bone
4) Eccentric location within the bone

Unicameral bone cysts have a typical radiographic appearance:

- Metaphyseal
- Purely lytic
- Expand the bone in a symmetric fashion
- Often border the growth plate
- May have trabeculations in them once they have fractured

One can usually distinguish aneurysmal bone cyst (ABC) from unicameral bone cyst by recognizing the eccentric nature of the ABC. Unicameral bone cysts will generally not expand the bone beyond the width of the physis. In contrast, ABC may markedly expand the cortex. As ABCs expand into the soft tissues, there is generally a thin rim of periosteal bone that outlines the expansion. With aneurysmal bone cyst, the lesion is eccentric. Normal bone is present bordering the lesion. In contrast, in unicameral bone cyst the entire medullary cavity is symmetrically involved.

Correct Answer: Eccentric location within the bone

3540. (100) Q9-145:

The most common locations of unicameral bone cysts are:

1) Proximal femur and distal
3) Proximal humerus and proximal femur
2) Proximal humerus and distal femur
5) Proximal femur and distal humerus
4) Proximal humerus and distal tibia

Unicameral bone cysts most commonly occur in the proximal humerus. The proximal femur is the second most common site.

Unicameral bone cysts have a typical radiographic appearance:

- Metaphyseal
- Purely lytic
- Expand the bone in a symmetric fashion
- Often border the growth plate
- May have trabeculations in them once they have fractured

Correct Answer: Proximal humerus and proximal femur

3541. (101) Q9-146:

Which of the following sarcomas characteristically has a translocation between chromosomes 11 and 22:

1) Dedifferentiated chondrosarcoma
3) Fibrosarcoma
2) Malignant fibrous histiocytoma
5) Post-irradiation sarcoma
4) Ewingâs tumor

Ewingâs tumor has a characteristic translocation between chromosomes 11 and 22 in 95% of cases. The translocation produces a fusion protein between the EWS and Fli-1 genes.

Correct Answer: Ewingâs tumor

3542. (102) Q9-147:

In which of the following bone tumors is CT scanning superior to MRI:

1) High-grade intramedullary osteosarcoma
3) Malignant fibrous histiocytoma
2) Ewingâs tumor
5) Giant cell tumor of bone
4) Osteoid osteoma

MRI has replaced CT for the imaging of almost all bone tumors. One exception is osteoid osteoma. Osteoid osteomas are small, lytic lesions (5 mm to 15 mm) that have a dense sclerotic rim. The nidus and its sclerotic rim are best identified with CT scans. The lesions can be detected with the MRI, but they can not be seen as clearly and may be easily missed.

High-grade intramedullary osteosarcoma, Ewingâs tumor, malignant fibrous histiocytoma, and giant cell tumor are best imaged with MRI scans.

Correct Answer: Osteoid osteoma

3543. (103) Q9-148:

Which of the following describes the typical appearance of metastatic bone disease in the spine:

1) Expansile, destructive lesion in the posterior elements
3) Diffuse osteopenia in the vertebral body
2) A 10-mm lytic area with surrounding sclerosis in the posterior elements
5) Destruction of a pedicle on one side
4) Completely collapsed vertebral body with increased width

One of the earliest findings in metastatic bone disease is destruction of a pedicle on one side of the vertebral body. Since the pedicle is composed of mostly cortical bone, one can detect the destruction easily on anteroposterior radiograph. In contrast, the lesion can progress through the vertebral body's cancellous bone without prominent bone destruction making detection difficult.

The other possible answers describe different entities:

Osteoblastoma or aneurysmal bone cyst:	Expansile, destructive lesion in the posterior elements
Osteoid osteoma:	A 10-mm lytic area with surrounding sclerosis in the posterior elements
Multiple myeloma:	Diffuse osteopenia in the vertebral body
Eosinophilic granuloma:	Completely collapsed vertebral body with increased width

Correct Answer: Destruction of a pedicle on one side

3544. (104) Q9-149:

Which of the following describes the typical radiographic appearance of eosinophilic granuloma in the spine:

1) Expansive, destructive lesion in the posterior elements
3) Diffuse osteopenia in the vertebral body
2) A 10-mm lytic area with surrounding sclerosis in the posterior elements
5) Destruction of a pedicle on one side
4) Completely collapsed vertebral body with increased width

Eosinophilic granuloma has a characteristic appearance in the spine. There is complete collapse of the vertebra and the vertebral body is often widened. This almost pathognomonic appearance is called 'vertebra plana.' Occasionally, Ewing's tumor or leukemia can have a similar appearance.

The other possible answers describe different entities:

Osteoblastoma or aneurysmal bone cyst:	Expansile, destructive lesion in the posterior elements
Osteoid osteoma:	A 10-mm lytic area with surrounding sclerosis in the posterior elements
Multiple myeloma:	Diffuse osteopenia in the vertebral body
Metastatic bone disease:	Destruction of a pedicle on one side

Correct Answer: Completely collapsed vertebral body with increased width

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3545. (105) Q9-150:

A 12-year-old boy has a destructive lesion in the proximal humerus. The lesion is in the proximal dia-metaphyseal region with destruction of about one-third of the cortical bone. The lesion is biopsied and is an eosinophilic granuloma (Langerhansâ cell granulomatosis). The best treatment method would be:

1) Wide resection and allograft reconstruction
3) High-dose external beam irradiation and chemotherapy
2) Preoperative chemotherapy followed by wide resection (allograft or prosthesis)
5) Intralesional corticosteroid injection
4) Multi-agent chemotherapy alone

Eosinophilic granuloma, or Langerhans cell granulomatosis, is a reactive condition that can often cause marked bone destruction. This condition usually occurs in children and young to middle aged adults.

The characteristic radiographic finding is a well-demarcated punched out lesion. The femur, humerus, and flat bones are common sites. Occasionally, patients may present with a very aggressive lesion with a permeative pattern of bone destruction, cortical bone destruction, and a soft tissue mass.

Eosinophilic granuloma is a self-limited disorder. There have been many different treatments proposed such as biopsy only, curettage and bone grafting, and low-dose irradiation. Most recently, intralesional cortisone injection has become the standard treatment for most lesions.

Correct Answer: Intralesional corticosteroid injection

3546. (106) Q9-151:

Which of the following is the most prominent feature of the presentation of children with osteosarcoma:

1) Painless mass
3) Pain with activity, relieved by rest
2) Recurrent atraumatic effusions
5) Pain following sports, especially running and jumping
4) Pain that may begin as intermittent and progresses to constant

Pain is the most prominent feature of high-grade malignant tumors in children and adults. The pain is a deep-seated pain and is usually well localized when the lesion is in the extremity. The pain begins as intermittent pain and then progresses to constant pain. The pain often occurs at night and at rest. As the tumor grows, the pain becomes constant and relentless.

Pain from malignant bone tumors:

- Is dull or sharp
- Is deep-seated
- Occurs at rest and at night
- Begins as intermittent discomfort and progresses to constant

Correct Answer: Pain that may begin as intermittent and progresses to constant

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3547. (107) Q9-152:

Enchondromas may commonly occur in all of the following sites except:

1) Proximal femur
3) Proximal humerus
2) Distal femur
5) Phalanges of the hand
4) Scapula

Enchondromas are hyaline cartilage tumors that occur in the medullary cavity. They are usually asymptomatic. They do not expand or cause major erosions of the cortical bone in long bones; however, in small bones enchondromas may cause cortical expansion.

In order of occurrence, the most frequent sites of enchondromas include:

- Small bones of the hands and feet (hand to feet ratio 7:1)
- Femur
- Proximal humerus
- Less common: forearm, tibia, and fibula

It is rare for enchondromas to occur in the following sites:

- Pelvis
- Ribs
- Scapula
- Vertebra

Correct Answer: Scapula

3548. (108) Q9-153:

Which of the following describes the most common mineralization pattern of high-grade intramedullary osteosarcomas:

1) Scattered stippling
3) Cloudy opacities that vary in size, shape, and density
2) Ring-like
5) Stippling with multiple rings and arcs
4) Flocculent

It is important to be able to recognize the mineralization pattern of lesions in both bone and soft tissue. Mineralization may occur in osteoid and hyaline cartilage. One can broadly say that the mineralization is bone formation, cartilage calcification, and amorphous calcification.

The following table is useful to remember when analyzing radiographs:

	Mineralization pattern	**Lesions**
Hyaline cartilage calcification	Fine stipples* Rings, arcs, commas	Enchondroma Low-grade intramedullary chondrosarcoma Dedifferentiated chondrosarcoma Osteochondroma Secondary surface chondrosarcoma Synovial chondromatosis
Bone formation	Cloud- or ivory-like (may be trabecular pattern in the bone)	Bone islands Heterotopic ossification Osteoblastoma Osteoid osteoma High-grade intramedullary osteosarcoma Low grade intramedullary osteosarcoma
Amorphous calcification	Nodular and flocculent† (multiple areas in most lesions)	Tumorous calcification Calcific tendinitis

* If one were to paint fine stippling, one would use a brush with a fine tip.
† If one were to paint the amorphous calcifications, one would use the main body of the brush, not a fine tip.

Correct Answer: Cloudy opacities that vary in size, shape, and density

3549. (110) Q9-155:

A 26-year-old man had Ewingâs tumor of the proximal humerus 14 years ago. He was treated with multi-agent chemotherapy and external beam irradiation. He now has pain in the proximal humerus and his radiographs show a lytic lesion with a small area of cortical bone destruction. The most likely diagnosis:

1) Stress fracture
3) Osteomyelitis
2) Radiation osteitis
5) Post-irradiation sarcoma
4) Recurrent Ewingâs tumors

Patients who have been treated with irradiation may develop two principal problems in their skeleton â insufficiency, or stress fractures, and post-irradiation sarcomas.

Fortunately, post-irradiation sarcomas are rare, but they may occur in a patient who has been cured of their cancer. Patients may have received either radiation alone or a combination of chemotherapy and radiation. The latency period (interval between the completion of the radiation therapy and onset of the sarcoma) varies between 5 to 50+ years. There have been some reports with post-irradiation sarcomas occurring within 2 to 5 years.

The symptoms of a post-irradiation sarcoma are pain and swelling. Occasionally, patients present with a mass only.

The key radiographic feature of a post-irradiation sarcoma is cortical bone destruction and the presence of a soft tissue mass. The cortical bone destruction may be appreciated on plain radiographs alone or with CT or MRI scans.

> NOTE: When patients with a history of cancer and irradiation present with skeletal pain and normal radiographs, the clinician should search further with a cross-sectional imaging modality, such as CT or MRI scans.

Correct Answer: Post-irradiation sarcoma

3550. (111) Q9-156:

Enchondromas may commonly occur in all of the following sites except:

1) Proximal femur
3) Proximal humerus
2) Distal femur
5) Phalanges of the hand
4) Vertebra

Enchondromas are hyaline cartilage tumors that occur in the medullary cavity. They are usually asymptomatic. They do not expand long bones or cause major erosions of the cortical bone. In contrast, enchondromas may cause cortical expansion in small bones.

In order of occurrence, the most frequent sites of enchondromas include:

- Small bones of the hands and feet (hand to feet ratio 7:1)
- Femur
- Proximal humerus
- Less common: forearm, tibia, and fibula

It is rare for enchondromas to occur in the following sites:

- Pelvis
- Ribs
- Scapula
- Vertebra

Correct Answer: Vertebra

3551. (112) Q9-157:

Which of the following bone tumors are sensitive to radiation (an appropriate dose will kill the tumor with acceptable side effects to normal tissues):

1) Lymphoma, myeloma, and metastatic carcinomas
3) Dedifferentiated chondrosarcoma, malignant fibrous histiocytoma, and Ewingâs tumor
2) Metastatic bone disease, myeloma, and malignant fibrous histiocytoma
5) Clear cell chondrosarcoma, mesenchymal chondrosarcoma, and Ewingâs tumor
4) Parosteal osteosarcoma, periosteal osteosarcoma, and high-grade surface osteosarcoma

The lesions that are sensitive to irradiation include:

- Metastatic carcinomas (renal cell carcinoma is more prone to recur following irradiation)
- Multiple myeloma
- Lymphoma

Most sarcomas are relatively radioresistant.

Correct Answer: Lymphoma, myeloma, and metastatic carcinomas

3552. (113) Q9-158:

Which of the following benign soft tissue tumors is very prone to local recurrence after surgical removal:

1) Nodular fasciitis
3) Angiolipoma
2) Lipoma
5) Extra-abdominal desmoid tumor
4) Schwannoma

Extra-abdominal desmoid tumors are very prone to local recurrence. Despite adequate surgery, these lesions may recur in up to 50% of patients. This lesion has an infiltrative growth pattern with prominent invasion of surrounding muscle. Local recurrences may be treated with repeat excision, external beam irradiation, or low-dose chemotherapy. If the lesion does not display active and progressive growth, then the local recurrence can be observed.

In contrast, many benign lesions can be treated with simple excision with a very low risk of local recurrence. Examples of this self-limited growth pattern include:

- Nodular fasciitis
- Lipoma
- Angiolipoma
- Schwannoma

Correct Answer: Extra-abdominal desmoid tumor

3553. (115) Q9-160:

In patients with localized high-grade intramedullary osteosarcoma (Stage II), what is the most important factor in regard to long-term disease-free survival:

1) Sex of the patient
3) Size of the initial tumor
2) Age of the patient
5) Presence or absence of soft tissue extension
4) Response to preoperative chemotherapy

The most important determinant of long-term disease-free survival is response to preoperative chemotherapy. Multiple histologic sections are analyzed to determine the amount of tumor necrosis. The most favorable survival occurs in those patients with 99% or 100% tumor kill. When less than 90% tumor necrosis is achieved, the response is judged to be poor and there is a significant risk for both local recurrence and systemic failure.

Sex, size, age, and presence of soft tissue extension are not strong predictors of survival.

Correct Answer: Response to preoperative chemotherapy

3554. (116) Q9-161:

In which of the following malignant tumors is bone marrow aspiration part of the initial staging evaluation:

1) High-grade intramedullary osteosarcoma
3) Clear cell chondrosarcoma
2) Dedifferentiated chondrosarcoma
5) Malignant fibrous histiocytoma
4) Ewingâs tumor

The staging evaluation is predicated on the most common site of metastases of various bone tumors. The most common site for virtually all high-grade bone tumors is to the lungs. While most high-grade sarcomas can also metastasize to bone, the bone metastases occur later rather than earlier.

In contrast, in Ewing's tumor the bone metastases occur early and are commonly present at initial presentation. Because of the propensity for early bone metastases, bone marrow aspiration is part of the staging evaluation for patients with Ewingâs tumor. These bone metastases may be present even when the bone scan is normal.

Correct Answer: Ewingâs tumor

3555. (117) Q9-162:

A 64-year-old man has a 6-month history of back pain. Serum laboratory studies show a hemoglobin level of 11 mg/dL and an erythrocyte sedimentation rate of 110 mm/hr. Based on these studies, the most likely diagnosis is:

1) Metastatic breast cancer
3) Multiple myeloma
2) Metastatic lung cancer
5) Fibrous dysplasia
4) Pagetâs disease

Patients with multiple myeloma often present with both anemia and an elevated sedimentation rate. The low hemoglobin level and elevated erythrocyte sedimentation rate occur in up to two-thirds of patients. Serum protein and urine protein electrophoresis are very sensitive tests to detect the myeloma protein and should be ordered whenever the clinician suspects multiple myeloma.

Correct Answer: Multiple myeloma

3556. (118) Q9-163:

In which of the following bone tumors is curettage performed as the primary method of treatment:

1) Dedifferentiated chondrosarcoma
3) Adamantinoma
2) Malignant fibrous histiocytoma
5) Well-differentiated intramedullary osteosarcoma
4) Giant cell tumor

There are four different surgical margins that can be achieved in oncologic surgery:
Intralesional: The plane of surgery goes through the tumor.
Marginal: The plane of surgery goes through the reactive zone of the lesion (the reactive zone contains edema, tumor cells, fibrous tissue, and inflammatory cells).
Wide: The plane of dissection goes through normal tissue.
Radical: The entire anatomic compartment of the lesion is removed.

Curettage is reserved for benign tumors or metastatic disease, in which radiation will be used to control whatever tumor cells have been left benign. Giant cell tumors of bone are treated with curettage. The curettage is extensive with exteriorization (removing the cortex off the tumor), followed by curetting the tumor with hand instruments and power tools. There is often a large defect left following the curettage.This defect is usually reconstructed with methyl methacrylate.

The following lesions are commonly treated with curettage:
Giant cell tumor
Chondroblastoma
Aneurysmal bone cyst
Osteoid osteoma

In contrast, malignant bone tumors are usually removed with a wide or radical surgical margin.

Correct Answer: Giant cell tumor

3557. (119) Q9-164:

Which of the following features of soft tissue sarcomas portends a favorable prognosis:

1) Deep location (below the fascia)
3) High-grade histology
2) Superficial location (above the fascia)
5) Lymph node involvement
4) Large size (>10 cm)

The following features of soft tissue sarcomas are associated with a more favorable prognosis:

- Small size (<5 cm)
- Low-grade
- Location above the fascia

Poor prognostic factors include:

- Large size (>5 cm)
- High-grade
- Location below the fascia
- Presence of regional metastases

Patients who have large, deep high-grade sarcomas have a high risk (up to 40% to 60%) of pulmonary metastases.

Correct Answer: Superficial location (above the fascia)

3558. (120) Q9-165:

In which of the following conditions is polyostotic involvement common:

1) Giant cell tumor
3) Chondromyxoid fibroma
2) Chondroblastoma
5) Desmoplastic fibroma
4) Fibrous dysplasia

Polyostotic involvement is common in a number of bone tumors. A useful differential diagnosis of multiple lesions is as follows in both young and old patients:

Â	**Benign**	**Malignant**
Younger Patients (age 10 to 40 years)	Eosinophilic granuloma (Langerhans cell granulomatosis) Fibrous dysplasia Multiple exostoses Multiple enchondromatosis	Epithelioid hemangioendothelioma Metastases: Neuroblastoma/Wilm's tumor (young children < 10 years old) Melanoma
Older Patients (age 40 to 80+ years)	Paget's disease Fibrous dysplasia Bone infarcts Hyperparathyroidism Mastocytosis	Metastatic carcinomas Multiple myeloma Lymphoma Epithelioid hemangioendothelioma

Correct Answer: Fibrous dysplasia

3559. (121) Q9-166:

Which of the following radiographic features helps in differentiating a chondrosarcoma from an enchondroma:

1) Stippled and ring-like calcification
3) Expansion of the cortex in a small bone
2) Small endosteal erosions (< 50% cortical width)
5) Absence of matrix calcification
4) Cortical perforation and cortical thickening

Enchondromas and chondrosarcomas are both intramedullary cartilage lesions. In the adult patient, enchondromas do not grow; they are inactive lesions. When an intramedullary cartilage lesion grows and destroys the bone, the lesion is a chondrosarcoma.

The hallmark feature of almost all chondrosarcomas is involvement of the cortical bone. The cortical bone involvement can manifest in several different ways:

Erosion of the cortex:	Endosteal erosion occurs slowly as the tumor grows; erosions that are greater than 50% of the thickness of the cortex are suggestive of a chondrosarcoma
Thickening of the cortex:	Most chondrosarcomas are low-grade lesions. The tumor grows slow and may gradually distort the cortex. With low-grade lesions, the endosteal surface may be resorbed with concomitant periosteal new bone formation of the periosteal surface. The cortex is then thickened by the endosteal erosion of the chondrosarcoma.
Destruction of the cortex:	Some chondrosarcomas simply destroy the cortex as they grow and the lesion then extends into the soft tissues. When there is complete bone destruction, these chondrosarcomas are usually of a higher grade.

Correct Answer: Cortical perforation and cortical thickening

3560. (122) Q9-167:

Which of the following osteosarcomas has minimal osteoid production when examined histologically:

1) Parosteal osteosarcoma
3) Well-differentiated intramedullary osteosarcoma
2) Periosteal osteosarcoma
5) Telangiectatic osteosarcoma
4) High-grade intramedullary osteosarcoma

Telangiectatic osteosarcomas are the one form of osteosarcoma where there may be minimal or no osteoid production by the tumor cells. The radiographs typically show a destructive, purely lytic lesion that is often expansile.

On low power viewing, there are usually large blood-filled spaces. The low-power appearance may be very similar to that seen with aneurysmal bone cyst. On high-power viewing, the cells that are in the cyst lining are malignant. The nuclei show pleomorphism and atypical features. There are often bizarre mitotic figures.

Correct Answer: Telangiectatic osteosarcoma

3561. (123) Q9-168:

In which of the following tumors are viral-like inclusion bodies found in the osteoclasts when studied with electron microscopy:

1) Fibrous dysplasia
3) Giant cell tumor
2) Pagetâs disease
5) Chondromyxoid fibroma
4) Chondroblastoma

In Pagetâs disease, there are viral-like inclusion bodies found in the osteoclasts. Because of these particles, some investigators believe Pagetâs disease may be caused by a slow virus. The findings that support a slow virus include: the long disease course, single organ system, and absence of fever. The viral-like particles may belong to the paramyxovirus family.

Correct Answer: Pagetâs disease

3562. (124) Q9-169:

Which of the following groups of carcinomas commonly produce sclerotic metastases to bone:

1) Breast and prostate
3) Lung and thyroid
2) Lung and kidney
5) Kidney and bladder
4) Lung and bladder

Bone metastases are usually of three patterns: predominantly lytic, mixed lytic-blastic, and purely blastic.

Common Patterns

Purely lytic
Lung
Kidney
Thyroid

Mixed lytic-blastic
Breast

Purely blastic
Prostate
Breast

Correct Answer: Breast and prostate

3563. (125) Q9-170:

Which of the following lesions is typically a Stage 1 lesion according to the staging system of the Musculoskeletal Tumor Society:

1) Giant cell tumor
3) Non-ossifying fibroma
2) Chondroblastoma
5) Osteoid osteoma
4) Osteoblastoma

Stage 1 lesions are inactive, or latent, lesions. These lesions do not cause symptoms and generally do not grow. There is no risk of pathologic fracture or other problems.

Non-ossifying fibroma, or fibrous cortical defect, is a developmental process that is usually discovered as an incidental finding. The lesions are usually small and affect less than 50% of the diameter of the cortical bone. When these lesions are small (< 50% of the diameter of the bone) and asymptomatic, patients are not restricted in their activity. A new radiograph is obtained at 6 to 12 months to ensure that the lesion is not enlarging.

Some patients with non-ossifying fibromas have active lesions that grow and cause symptoms. Patients occasionally sustain fractures following minor trauma. In the scenarios that involve pain or fracture, the non-ossifying fibroma would be classified as a Stage 2 lesion.

Correct Answer: Non-ossifying fibroma

3564. (126) Q9-171:

Which of the following bone lesions is typically treated by intralesional curettage:

1) Dedifferentiated chondrosarcoma
3) Adamantinoma
2) Malignant fibrous histiocytoma
5) Well-differentiated intramedullary osteosarcoma
4) Aneurysmal bone cyst

There are four different surgical margins that can be achieved in oncologic surgery:
Intralesional: The plane of surgery goes through the tumor.
Marginal: The plane of surgery goes through the reactive zone of the lesion (the reactive zone contains edema, tumor cells, fibrous tissue, and inflammatory cells).
Wide: The plane of dissection goes through normal tissue.
Radical: The entire anatomic compartment of the lesion is removed.

Curettage is reserved for benign tumors or malignant tumors, in which radiation will be used to control whatever tumor cells have been left benign. Giant cell tumors of bone are treated with curettage. The curettage is extensive with exteriorization (removing the cortex off the tumor), followed by curetting the tumor with hand instruments and power tools. There is often a large defect left following the curettage.This defect is usually reconstructed with methyl methacrylate.

The following lesions are commonly treated with curettage:
Giant cell tumor
Chondroblastoma
Aneurysmal bone cyst
Osteoid osteoma

In contrast, malignant bone tumors are usually removed with a wide or radical surgical margin.

Correct Answer: Aneurysmal bone cyst

3565. (127) Q9-172:

Which of the following bone tumors is typically treated with intralesional curettage:

1) Dedifferentiated chondrosarcoma
3) Adamantinoma
2) Malignant fibrous histiocytoma
5) Well-differentiated intramedullary osteosarcoma
4) Giant cell tumor

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The following lesions are commonly treated with curettage:
Giant cell tumor
Chondroblastoma
Aneurysmal bone cyst
Osteoid osteoma

Correct Answer: Giant cell tumor

3566. (128) Q9-173:

Which of the following carcinomas typically produces purely lytic bone metastases:

1) Lung and breast
3) Bladder and thyroid
2) Lung and prostate
5) Breast and prostate
4) Kidney and lung

Bone metastases are usually of three patterns: predominantly lytic, mixed lytic-blastic, and purely blastic.

Common Patterns

Purely lytic
Lung
Kidney
Thyroid

Mixed lytic-blastic
Breast

Purely blastic
Prostate
Breast

Correct Answer: Kidney and lung

3567. (129) Q9-174:

In which of the following metastatic carcinomas is preoperative embolization useful to decrease bleeding in large lesions with soft tissue extension:

1) Adenocarcinoma of the lung
3) Renal cell carcinoma
2) Breast cancer
5) Small cell cancer of the lung
4) Prostate cancer

Renal cell carcinomas can be very vascular lesions. There may be thousands of small and large blood vessels supplying the lesion. Lesion with marked expansion of the bone or large soft tissue masses are especially at risk for massive bleeding.

Preoperative embolization is an excellent method of reducing intraoperative bleeding. Patients are usually embolized once within 1 week of surgery. Occasionally, a very vascular lesion may require more than one separate angiographic procedures to complete the embolization.

Correct Answer: Renal cell carcinoma

3568. (130) Q9-175:

Which of the following lesions is high signal on T1 weighted images and moderate signal on T2 weighted images:

1) Malignant fibrous histiocytoma
3) Synovial sarcoma
2) Extra-abdominal desmoid tumor
5) Ganglion
4) Lipoma

Lipomas are composed of mature adipose tissue. Mature adipose tissue is high signal on T1 weighted images and moderate on T2 weighted images.

It is important to remember the appearances of common tissues on both T1 and T2 weighted images:

Â	**T1 weighted**	**T2 weighted**
Fat	High	Moderate
Tendons	Low	Low
Ligaments	Low	Low
Fascial layers	Low	Low
Cortical bone	Low	Low
Muscle	Moderate	Moderate
Normal marrow	High	Moderate
Soft tissue sarcomas	Low	High
Fluid (ganglions, effusions)	Low	High

Pigmented villonodular synovitis will often have signal drop out (dark black) on gradient echo sequences.

Correct Answer: Lipoma

3569. (133) Q9-178:

Which of the following describes the histologic features of Ewingâs tumor:

1) A mixed population of inflammatory cells
3) A population of bi-lobed cells with red granules and Langerhansâ cells
2) A single population of small blue cells
5) Numerous cells with eccentric nuclei, clock-face chromatin, and a prominent peri-nuclear halo
4) Spindle cells with pleomorphism producing osteoid

Ewing's tumor is an anaplastic tumor that is composed of a single population of small blue cells on hematoxylin and eosin staining. The cells do not produce a matrix such as bone, cartilage, or fibrous tissue. Because there is no matrix, the tissue is very loose (may not stay together when removed) and may resemble infection (pus-like substance).

The other possible answers describe common bone lesions:

Infection:	A mixed population of inflammatory cells
Eosinophilic granuloma:	A population of bi-lobed cells with red granules (eosinophils) and Langerhans cells
Osteosarcoma:	Spindle cells with pleomorphism producing osteoid
Myeloma:	Numerous cells with eccentric nuclei, clock-face chromatin, and a prominent peri-nuclear halo

Correct Answer: A single population of small blue cells

3570. (134) Q9-179:

Pagetâs disease is most common in which of the following countries:

1) France
3) Italy
2) United Kingdom
5) Russia
4) Spain

Pagetâs disease is very common in Europe. The highest incidence is in the United Kingdom. It is less common in Scandinavia, France, Italy, Central Europe, and Russia (Dorfman). Pagetâs disease is also common in Australia and New Zealand, secondary to those countriesâ ancestries coming from the United Kingdom. As patients age, Pagetâs disease can be found in up to 3% to 5 % of the population.

Correct Answer: United Kingdom

3571. (135) Q9-180:

Which of the following radiographic descriptions describes the features of sarcoma occurring in Pagetâs disease:

1) Irregular increased density with a cotton wool-like appearance with interspersed radiolucency
3) Large areas of bone sclerosis
2) Bone is enlarged with prominent deformity
5) Osteolytic area with cortical bone destruction
4) Patchy sclerosis

Paget's disease has very characteristic radiographic patterns. The disease is divided into three phases: lytic, mixed lytic-sclerotic, and sclerotic phase.

In the sclerotic and mixed phase, the radiographic findings are easy to recognize:

Sclerotic phase
Irregular increased density with cotton wool-like appearance with interspersed radiolucency
Bones are usually enlarged
There may be prominent deformity
In long bones, the disease begins at one end and proceeds to the other

Intermediate phase
Patchy sclerosis

Lytic phase
In the lytic phase, there may be purely radiolucent findings
There is often mild expansion of the bone
The cortices are thinned but intact

When a sarcoma has developed within the bone, there is usually cortical bone destruction and a major lytic focus. Periosteal reaction is usually absent and there is often a large soft tissue mass.

Correct Answer: Osteolytic area with cortical bone destruction

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3572. (136) Q9-181:

Enchondromas may commonly occur in all of the following sites except:

1) Proximal femur
3) Proximal humerus
2) Distal femur
5) Phalanges of the hand
4) Pelvis

Enchondromas are hyaline cartilage tumors that occur in the medullary cavity. They are usually asymptomatic. They do not expand long bones or cause major erosions of the cortical bone. They may, however, cause cortical expansion in small bones.

In order of occurrence, the most frequent sites of enchondromas include:

- Small bones of the hands and feet (hand to feet ratio 7:1)
- Femur
- Proximal humerus
- Less common: forearm, tibia, and fibula

It is rare for enchondromas to occur in the following sites:

- Pelvis
- Ribs
- Scapula
- Vertebra

Correct Answer: Pelvis

3573. (137) Q9-182:

All of the following histologic features are typical of enchondromas except:

1) Low cellularity
3) Lobular architecture
2) Small, round nuclei
5) Occasional binucleate cells
4) Prominent myxoid change

Enchondromas usually do not display active growth either radiographically or histologically. This intramedullary lesion does not involve the cortex in long tubular bones; there is no major cortical erosion, cortical thickening, or cortical breakthrough.

- Histologically, enchondromas have the following features:
  Low cellularity
  Small, round nuclei
  Occasional binucleate cells
  Individual chondrocytes are small and lie in lacunae
  Foci of fine or coarse calcifications or enchondral bone can be seen
- Prominent myxoid change is not seen.
- Small focal areas of myxoid change can be seen in enchondromas of the hand.
- *Enchondromas of the hands/feet*: Enchondromas in these locations may show hyper-cellularity, atypical nuclear features, and small amounts of myxoid change yet still be benign lesions.

Correct Answer: Prominent myxoid change

3574. (138) Q9-183:

A 48-year-old woman has an enchondroma in the proximal humerus. She has pain with overhead activity and her shoulder hurts at night when she lies on it. The radiographs show no cortical erosions, cortical thickening, or other worrisome changes. Management at this point should be:

1) Open incisional biopsy
3) Curettage and bone grafting
2) Needle biopsy through the deltoid muscle
5) Observation with new radiographs in 3 to 6 months
4) Wide resection and allograft prosthetic reconstruction

Enchondromas are generally treated with observation. They are common and many patients will have symptoms secondary to other entities, such as rotator cuff tendinitis, biceps tendinitis, greater trochanteric bursitis, and other overuse and degenerative conditions. When an intramedullary hyaline cartilage lesion looks innocent on plain radiographs â no major endosteal erosions, cortical breakthrough, or thickening â the lesion is best regarded as an enchondroma. In the asymptomatic patient or the patient who has pain secondary to tendinitis or other condition, observation should be chosen rather than surgical treatment. New radiographs are taken usually at 3 to 6 months and again at 6 months. If the lesion has not changed on 3 series of radiographs over 12 to 24 months, the lesion can be safely regarded as an enchondroma.

Correct Answer: Observation with new radiographs in 3 to 6 months

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3575. (139) Q9-184:

The most common site of periosteal chondromas is:

1) Proximal femur
3) Proximal humerus
2) Distal femur
5) Proximal tibia
4) Hand metacarpals

Periosteal chondromas are rare lesions. Over 50% of the time, they are located in the proximal humerus. Other locations include the distal femur, proximal tibia, and the hand.

Periosteal chondromas have typical radiographic appearances:

- They are small, usually 3 cm to 5 cm.
- They sit on the top of the bone in an excavation in the cortex.
- There is a buttress of periosteal bone on either side of the lesion.
- About one-third of radiographs show mineralization from within.

Correct Answer: Proximal humerus

3576. (141) Q9-192:

Figure 1

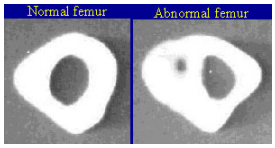


Figure 2

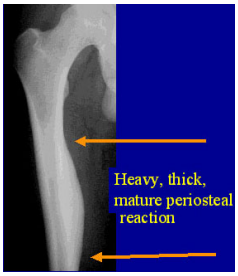


Figure 3

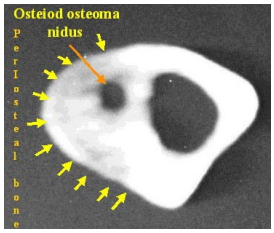


Figure 4

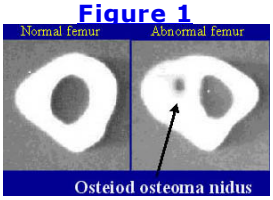


Figure 5

A 15-year-old boy presents with a 9-month history of severe thigh pain. The pain is most severe at night and aspirin completely relieves the pain. The plain radiograph is shown in Figure 1 and the CT scan in Figure 2. The most likely diagnosis is:

1) Stress fracture
3) Parosteal osteosarcoma
2) Osteomyelitis
5) Osteoblastoma
4) Osteoid osteoma

The plain radiograph shows a heavily mineralized lesion on the medial aspect of the femoral shaft (Figure 3). The periosteal reaction is mature without evidence of a lytic focus. The heavy mineralization is suggestive of an osteoid osteoma, but the diagnosis cannot be made without identifying the nidus. The CT scan shows a small, 8-mm lytic focus in the medial cortex. Heavy periosteal new bone surrounds the lesion (Figure 4). When comparing the CT scans of the left and right femurs, one can see the abnormal shape of the medial aspect of the femur with a lytic focus located in the medial femoral cortex (Figure 5).

The essential features of osteoid osteoma are:

- Small lytic nidus is between 5 mm and 10 mm.
- Nidus is surrounded by heavy periosteal new bone formation.
- Often, CT scans are the only way to demonstrate the nidus.

Correct Answer: Osteoid osteoma

3577. (142) Q9-193:

Figure 1

A 15-year-old boy presents with a 9-month history of severe thigh pain. The pain is most severe at night and aspirin completely relieves the pain. The plain radiograph is shown in Figure 1. The imaging study of choice to establish the diagnosis for this patient would be:

1) Magnetic resonance imaging (MRI) scan
3) Single proton emission computerized tomography (SPECT) scan
2) Technetium bone scan
5) High-resolution ultrasound
4) Computerized tomography (CT) scan

The history of severe night pain and pain responsive to nonsteroidal anti-inflammatory medications suggests that the patient has an osteoid osteoma. Osteoid osteomas are small tumors, with the nidus being the essential component of the lesion. The nidus is small (5 mm to 10 mm) and is often surrounded by heavy periosteal new bone. The center of the nidus is often mineralized. CT scans are the best method to identify the lytic focus embedded in the cortical bone.

A MRI scan is a superb method to identify bone and soft tissue neoplasms. However, CT scanning is the best method to identify osteoid osteomas. MRI is less sensitive and specific than CT because the nidus may be mineralized in the center causing it to blend with and not be easily distinguished from the periosteal bone.

Technetium bone scanning is a sensitive technique used to detect increased activity in an osteoid osteoma, but when one recognizes the increased activity, the increase is non-specific. The increased activity may be secondary to a stress fracture, osteomyelitis, benign or malignant neoplasm.

Correct Answer: Computerized tomography (CT) scan

3578. (143) Q9-194:

Figure 1

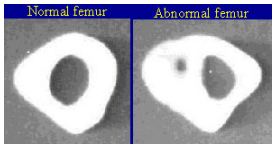


Figure 2

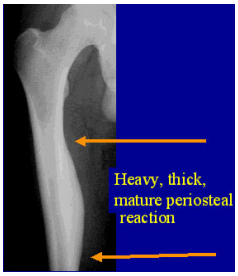


Figure 3

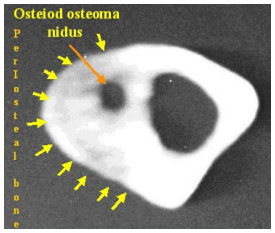


Figure 4

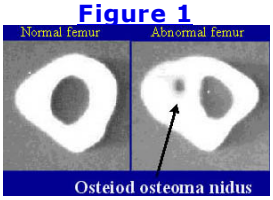


Figure 5

A 15-year-old boy presents with a 9-month history of severe thigh pain. The pain is most severe at night. He is unable to concentrate in school due to the pain. The plain radiograph is shown in Figure 1 and the CT scan in Figure 2. The most appropriate initial treatment method would be:

1) Physical therapy
3) Anti-inflammatory medication
2) Needle or open biopsy
5) En bloc resection and reconstruction
4) Observation

The radiograph and CT scan show the classic features of an osteoid osteoma. As many as 50% of patients can be successfully treated with the initial treatment of nonsteroidal anti-inflammatory drugs (Kniesel and Simon).

If nonoperative treatment fails, surgical therapy is aimed at removing the nidus completely. This can be done percutaneously with CT guided radiofrequency ablation or surgical removal with burring of the bed of the osteoid osteoma following removal.

To answer this question correctly, one must be able to recognize the classic features of osteoid osteoma:

- Small lytic nidus is between 5 mm and 10 mm.
- Nidus is surrounded by heavy periosteal new bone formation.
- Often, CT scans are the only way to demonstrate the nidus.

The plain radiograph shows a heavily mineralized lesion on the medial aspect of the femoral shaft (Figure 3). The periosteal reaction is mature without evidence of a lytic focus. The heavy mineralization is suggestive of an osteoid osteoma, but the diagnosis cannot be made without identifying the nidus. The CT scan shows a small, 8-mm lytic focus in the medial cortex. Heavy periosteal new bone surrounds the lesion (Figure 4). When comparing the CT scans of the left and right femurs, one can see the abnormal shape of the medial aspect of the femur with a lytic focus located in the medial femoral cortex (Figure 5).

Correct Answer: Anti-inflammatory medication

3579. (144) Q9-195:

Figure 1

Figure 2

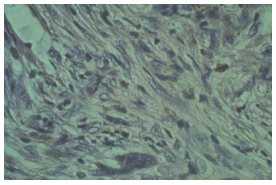


Figure 3

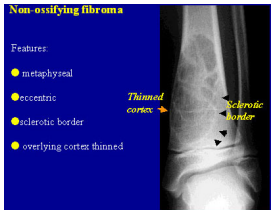


Figure 4

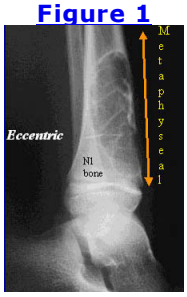


Figure 5

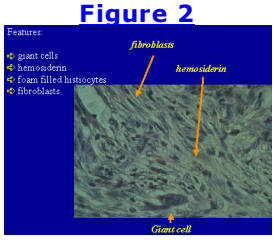


Figure 6

A 10-year-old boy injured his leg playing baseball. He now has pain whenever he bears weight on his extremity. He has no rest pain or other medical problems. The plain radiographs are shown in Figures 1 and 2, and a biopsy specimen is shown in Figure 3. The most likely diagnosis is:

1) Giant cell tumor
3) Non-ossifying fibroma
2) Aneurysmal bone cyst
5) Ewingâs tumor
4) Osteosarcoma

The plain radiograph shows the distinctive features (Figures 4 and 5) of a non-ossifying fibroma.

Radiographic features of a non-ossifying fibroma:

- Metaphyseal
- Eccentric
- Well-defined sclerotic rim
- Thinned, but intact, overlying cortex

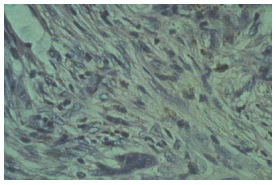
The biopsy specimen shows the typical characteristics (Figure 6):

- Fibroblasts
- Giant cells
- Foam-filled histiocytes
- Hemosiderin pigment

Treatment:
When asymptomatic, non-ossifying fibromas are treated with observation. This lesion is painful and at risk for fracture because of the activity-related pain. Treatment is curettage and bone grafting.

Correct Answer: Non-ossifying fibroma

3580. (145) Q9-196:



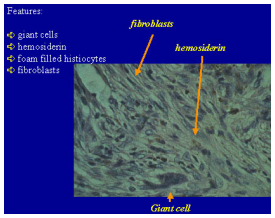


Figure 1 **Figure 2** **Figure 3** **Figure 4**

A 10-year-old boy injured his leg playing baseball. He now has pain whenever he bears weight on his extremity. He has no rest pain or other medical problems. The plain radiographs are shown in Figures 1 and 2, and a biopsy specimen is shown in Figure 3. The most appropriate treatment method would be:

1) Preoperative chemotherapy and wide resection
3) Aspiration and methyl prednisolone acetate injection
2) Below-knee amputation
5) Debridement, methyl methacrylate antibiotic beads, and intravenous antibiotics
4) Curettage and bone grafting

To answer this question, one must first make the correct diagnosis and then select a treatment for that diagnosis. The radiographic and histologic features presented are most consistent with non-ossifying fibroma.

Radiographic features of a non-ossifying fibroma:

- Metaphyseal
- Eccentric
- Well-defined sclerotic rim
- Thinned, but intact, overlying cortex

The biopsy specimen shows the typical characteristics (Figure 6):

- Fibroblasts
- Giant cells
- Foam-filled histiocytes
- Hemosiderin pigment

Treatment:
When asymptomatic, non-ossifying fibromas are treated with observation. This lesion is painful and at risk for fracture because of the activity related pain. Treatment is curettage and bone grafting.

The other possible answers are for distinct entities:

Preoperative chemotherapy and wide resection â osteosarcoma
Below-knee amputation â unresectable sarcoma
Aspiration and methyl prednisolone acetate injection â unicameral bone cyst, eosinophilic granuloma
Debridement, methyl methacrylate antibiotic beads, and intravenous antibiotics â osteomyelitis

Correct Answer: Curettage and bone grafting

3581. (146) Q9-197:

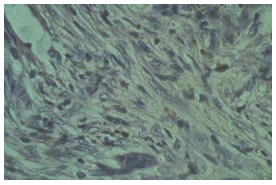


Figure 1 **Figure 2** **Figure 3**

A 10-year-old boy injured his leg playing baseball. He now has pain whenever he bears weight on his extremity. He has no rest pain or other medical problems. The plain radiographs are shown in Figures 1 and 2, and a biopsy specimen is shown in Figure 3. What would be the appropriate stage according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage III
4) Stage II

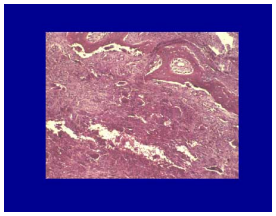
The radiographic and histologic features are consistent with non-ossifying fibroma. Because the lesion is symptomatic, the lesion is active. Non-ossifying fibromas have a low local recurrence rate and they never threaten the involved joint. Hence, this would be a Stage 2 lesion.

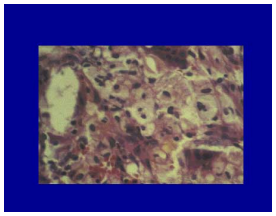
The Surgical Staging System of the Musculoskeletal Tumor Society is a useful system to both predict prognosis and plan treatment. The system for benign lesions is divided into three groups: inactive (latent), active, and aggressive:

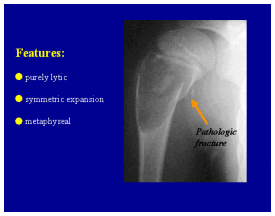
Stage 1: Inactive (latent)	Refers to lesions that are not causing pain and show no evidence of active growth. Stage 1 lesions are generally treated with observation only.
Stage 2: Active	Refers to lesions that are causing pain or some form of disability. If a lesion has weakened the structure of the bone such that fracture may occur, the lesion would be considered a Stage 2 lesion.
Stage 3: Aggressive	Refers to lesions that are large, have broken into the soft tissues, or have caused a pathologic fracture. These lesions are usually prone to local recurrence and have the potential of causing a major problem for the patient.

Correct Answer: Stage 2

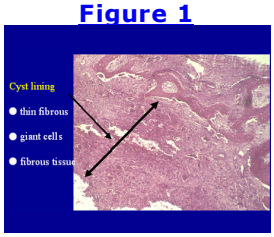
3582. (147) Q9-198:



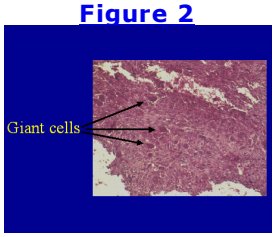




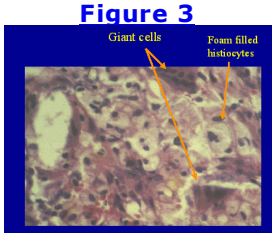
[Figure 1](#)



[Figure 2](#)



[Figure 3](#)



[Figure 4](#)

[Figure 5](#)

[Figure 6](#)

[Figure 7](#)

A 10-year-old boy has immediate pain after throwing a baseball. He is unable to elevate his arm due to pain. The child has no medical problems. An anteroposterior radiograph of the shoulder is shown in Figure 1. The most likely diagnosis based on the history and radiograph is:

1) Giant cell tumor of bone
3) Ewingâs tumor
2) Aneursymal bone cyst
5) Osteosarcoma
4) Unicameral bone cyst

The plain radiograph shows a lytic metaphyseal lesion with symmetric expansion and thinned cortices. A minimally displaced fracture is also present. This is the classic appearance or a unicameral bone cyst.

Radiographic features of a unicameral bone cyst (Figure 2):

- Metaphyseal
- Purely lytic
- Symmetric expansion (approximately equal in width to the growth plate)
- Thinned but intact cortices

The most common location of a unicameral bone cyst is the proximal humerus, followed by the proximal femur.

The other possible answers have different radiographic and clinical features:

Giant cell tumor:	Uncommon in children with open physes; lesions start in the metaphysis and extend into the epiphysis often abutting the subchondral bone.
Aneurysmal bone cyst:	Metaphyseal, expansile lesion that is eccentric. The lesion often extends into the soft tissues and is covered by a thin shell of periosteal bone.
Ewingâs tumor:	Lytic, destructive lesion, often with periosteal reaction.
Osteosarcoma:	Metaphyseal lesion with mixed pattern of bone destruction and bone formation.

Correct Answer: Unicameral bone cyst

3583. (148) Q9-199:

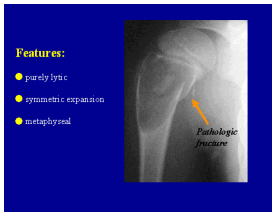


Figure 1 **Figure 2**

A 10-year-old boy has immediate pain after throwing a baseball. He is unable to elevate his arm due to pain. The child has no medical problems. An anteroposterior radiograph of the shoulder is shown in Figure 1. The most appropriate treatment for this condition is:

1) Preoperative chemotherapy followed by wide resection
3) Wide resection and allograft reconstruction
2) Chemotherapy and external beam irradiation
5) Curettage and augmentation with methyl methacrylate
4) Methyl prednisolone acetate injection

To answer this question, one must be able to establish the diagnosis from the radiographs.
The diagnosis is unicameral bone cyst.

The plain radiograph shows a lytic metaphyseal lesion with symmetric expansion and thinned cortices. There is also a minimally displaced fracture. This is the classic appearance of a unicameral bone cyst.

Radiographic features of a unicameral bone cyst (Fig. 2):

- Metaphyseal
- Purely lytic
- Symmetric expansion (about equal in width to the growth plate
- Thinned, but intact, cortices

The treatment of unicameral bone cysts is aspiration of the cyst and injection with methyl prednisolone acetate (150 mg to 200 mg). Many cysts resolve with a single injection, whereas some require more than one aspiration/injection.

Correct Answer: Methyl prednisolone acetate injection

3584. (149) Q9-200:

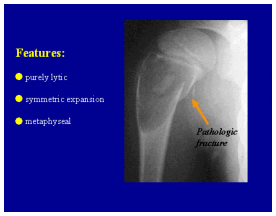


Figure 1 **Figure 2**

A 10-year-old boy has immediate pain after throwing a baseball. He is unable to elevate his arm due to pain. The child has no medical problems. An anteroposterior radiograph of the shoulder is shown in Figure 1. The most likely diagnosis is:

1) Giant cell tumor
3) Unicameral bone cyst
2) Aneursymal bone cyst
5) Osteosarcoma
4) Ewingâs tumor

The plain radiograph shows a lytic metaphyseal lesion with symmetric expansion and thinned cortices. There is also a minimally displaced fracture. This is the classic appearance of a unicameral bone cyst.

Radiographic features of a unicameral bone cyst:

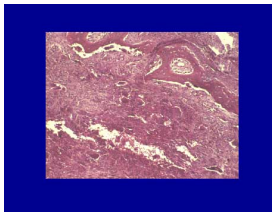
- Metaphyseal
- Purely lytic
- Symmetric expansion (about equal in width to the growth plate)
- Thinned, but intact, cortices

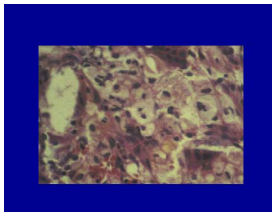
The key histologic features are:

- Thin fibrous lining
- Scattered giant cells
- Lipophages or foam-filled histiocytes

Correct Answer: Unicameral bone cyst

3585. (150) Q9-201:





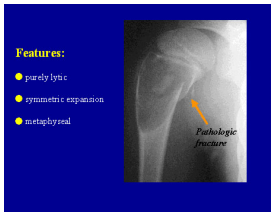


Figure 1 **Figure 2** **Figure 3** **Figure 4**

A 10-year-old boy has immediate pain after throwing a baseball. He is unable to elevate his arm due to pain. The child has no medical problems. An anteroposterior radiograph of the shoulder is shown in Figure 1. A biopsy is performed and the low- and high-power histologic sections are shown in Figures 2 and 3. The most appropriate treatment would be:

1) Preoperative chemotherapy followed by surgical resection
3) Surgical resection and allograft reconstruction
2) Chemotherapy and external beam irradiation
5) Curettage and cement augmentation
4) Aspiration and injection with methyl prednisolone acetate

To answer this question, one must make a diagnosis based on the radiograph and histologic sections:
The diagnosis is unicameral bone cyst.

The plain radiograph shows a lytic metaphyseal lesion with symmetric expansion and thinned cortices. Also present is a minimally displaced fracture. This is the classic appearance of a unicameral bone cyst.

Radiographic features of a unicameral bone cyst:

- Metaphyseal
- Purely lytic
- Symmetric expansion (about equal in width to the growth plate)
- Thinned but intact cortices

Histologic features of a unicameral bone cyst:

- Thin fibrous lining
- Scattered giant cells
- Lipophages or foam-filled histiocytes

The treatment of unicameral bone cysts is aspiration of the cyst and injection with methyl prednisolone acetate (150 mg to 200 mg). Many cysts resolve with a single injection, whereas some require more than one aspiration/injection.

Correct Answer: Aspiration and injection with methyl prednisolone acetate

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3586. (151) Q9-202:

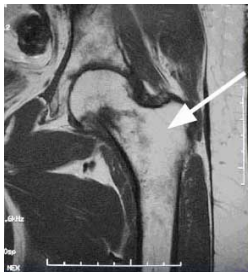


Figure 1 **Figure 2** **Figure 3**

A 72-year-old woman presents with a 2-week history of increasing hip pain following a minor fall. All of her pain is activity related. Physical examination is normal with an excellent range of motion and no focal tenderness. The plain radiographs and T1- and T2-weighted coronal MRI scans are shown in Figures 1, 2 and 3 respectively. The most likely diagnosis is:

1) Metastatic carcinoma
3) Lymphoma
2) Multiple myeloma
5) Avascular necrosis
4) Stress fracture

The plain radiographs of the hip are normal with the exception of osteopenia. The clue in the case presentation is the weight bearing pain. Stress fractures may occur following a fall in elderly patients. Physical examination is often completely normal.

The MRI scan shows a linear low-signal area across the subcapital region of the femoral neck. This is specific for a stress fracture. The T2-weighted coronal image shows high-signal corresponding to marrow edema surrounding the fracture line.

The treatment of this patient is multiple screw fixation of the femoral neck.

Correct Answer: Stress fracture

3587. (152) Q9-203:

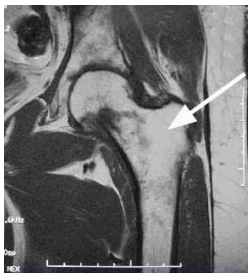


Figure 1 **Figure 2** **Figure 3**

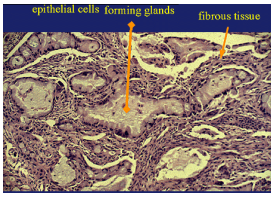
A 72-year-old woman presents with a 2-week history of increasing hip pain following a minor fall. All of her pain is activity related. Physical examination is normal with an excellent range of motion and no focal tenderness. The plain radiographs and T1- and T2-weighted coronal MRI scans are shown in Figures 1, 2 and 3 respectively. The high-signal areas correspond to:

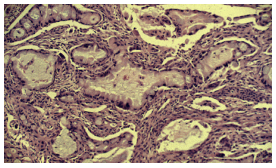
1) Normal marrow signal
3) Cortical bone
2) Marrow with edema
5) Neoplasm
4) Articular cartilage

The arrows point to high-signal areas that are normal marrow. T1-weighted coronal images are an excellent method to screen the bone marrow to look for lesions. Pathologic tissue on T1-weighted images usually show a low-signal. The low-signal abnormal areas are then sharply contrasted with the normal marrow that is high signal.

Correct Answer: Normal marrow signal

3588. (938) Q9-1227:





Slide 1 **Slide 2** **Slide 3**

A 55-year-old man has a three month history of increasing elbow pain. His past medical history is significant for coronary artery disease. He has a 30-pack per year smoking history. Initial radiographs of his elbow were normal. The plain radiograph of his elbow is shown three months later in Slide 1 and a biopsy of the destructive lesion is shown in Slide 2.The most likely diagnosis is:

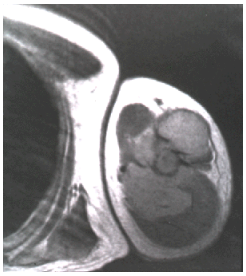
1) Metastatic adenocarcinoma
3) Lymphoma
2) Multiple myeloma
5) Paget disease
4) Osteomyelitis

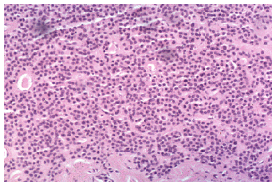
The plain radiograph shows a destructive lesion in the metaphysis of the distal humerus with expansion of the medial cortex. This appearance is characteristic of a bone malignancy. The differential diagnosis includes metastatic bone disease, myeloma, lymphoma, primary mesenchymal tumors (chondrosarcoma and malignant fibrous histiocytoma).

The histology section shows epithelial cells forming glands in a background of fibroblasts. This patient has metastatic carcinoma.

Correct Answer: Metastatic adenocarcinoma

3589. (939) Q9-1230:





Slide 1 **Slide 2** **Slide 3**

A 50-year-old man has a 3-month history of increasing pain in his arm. He is a plumber and the pain has increased in his arm to the point where he cannot work. He is otherwise healthy and has no medical problems. His plain radiograph (Slide 1) and magnetic resonance image (Slide 2) are shown below. A needle biopsy is also shown (Slide 3).
Other tests are as follows:

- CXR: normal
- Lab tests:
  - CBC â normal
  - CHEM GROUP â normal
  - ESR â normal

The most likely diagnosis based on the history, imaging studies, and biopsy is:

1) Metastatic bone disease
3) Myeloma
2) Lymphoma
5) Paget disease
4) Hyperparathyroidism

The correct diagnosis is myeloma of bone. The radiographic appearance of this lesion reveals a pathologic fracture and a diffuse lytic pattern. These can be seen in metastatic bone disease, myeloma, lymphoma, and hyperparathyroidism. In this particular question, the examinee must be able to recognize the histologic features of the myeloma â plasma cell neoplasm.

The essential features of plasma cells are:

- Eccentric nucleus
- Peripheral chromatin pattern
- A perinuclear halo (site of the Golgi apparatus)

Myeloma is a common disease and all physicians should be aware of its essential features.Correct Answer: Myeloma

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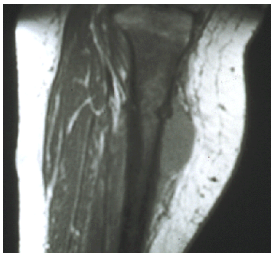
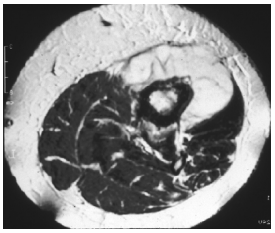
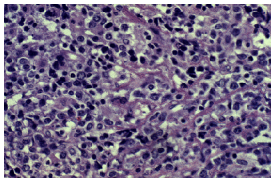
3590. (940) Q9-1231:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 50-year-old woman presented with a 1-year history of shin and knee pain. A presumptive diagnosis of Paget disease had been made and she was treated with anti-Pagetic medications. Her pain continued and a new anteroposterior radiograph of her femur was taken (Slide 1). A coronal and axial magnetic resonance imaging scan (Slides 2 and Slide 3) and a biopsy of the soft tissue mass were also taken (Slide 4).Immunostaining was negative for keratin but postive for CD20
The most likely diagnosis is:

1) Metastatic bone disease
3) Lymphoma
2) Myeloma of bone
5) Sarcoma complicating Paget disease
4) Osteosarcoma of bone

The histology of lymphoma is a mixed blue cell infiltrate of round cells, which may be small and large.Correct Answer: Lymphoma

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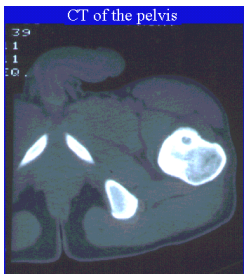
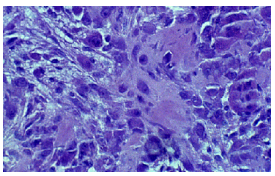
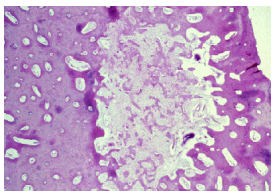
3591. (941) Q9-1232:



Slide 1 **Slide 2** **Slide 3** **Slide 4**

An 18-year-old male presented with a 6-month history of hip pain. His pain occurred both at rest and at night. His parents noticed a significant limp, and he felt his leg was much weaker. The plain radiograph and computerized tomography (CT) scan of the hip are shown (Slide 1 and Slide 2). The low- and high-power hematoxylin and eosin histologic sections are also presented (Slide 3 and Slide 4).
The most likely diagnosis is:

1) Low-grade osteosarcoma
3) Parosteal osteosarcoma
2) High-grade intramedullary osteosarcoma
5) Osteoid osteoma
4) Osteoblastoma

Osteoid osteoma is a self-limited benign bone tumor with a small nidus (usually less than 1.5 cm) surrounded by reactive bone formation. Histologically, the lesion is well demarcated.The CT scan shows the lucent nidus is surrounded by scelentic bone.Correct Answer: Osteoid osteoma

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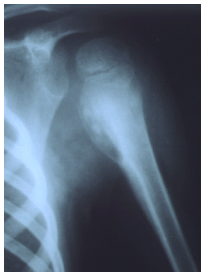
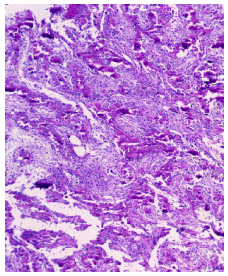
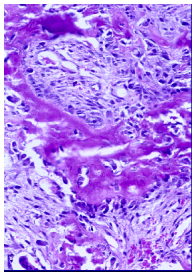
3592. (942) Q9-1233:







Slide 1 **Slide 2** **Slide 3**

A 13-year-old boy presented with a 6-month history of shoulder pain. His pain occurs both at rest and with activity. He feels the pain at night and has difficulty sleeping. The plain radiograph is shown (Slide 1). The low- and high-power hematoxylin and eosin sections are also presented (Slide 2 and Slide 3).
The most likely diagnosis based on the radiographs and biopsy material is:

1) Osteoblastoma
3) Parosteal osteosarcoma
2) High-grade intramedullary osteosarcoma
5) Osteomyelitis
4) Osteoid osteoma

Osteoblastomas typically have an oval area of bone destruction and there is evidence of bone production within the lesion. Histologically, one can see anastomosing bony trabeculae in a loose fibrovascular stroma. The bone trabeculae are usually lined with osteoblasts.Correct Answer: Osteoblastoma

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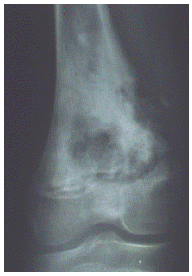
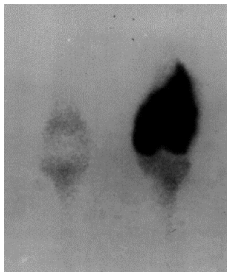
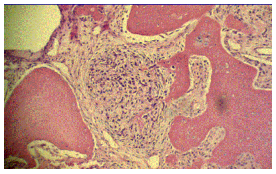
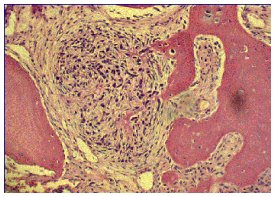
3593. (943) Q9-1234:









Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 13-year-old boy has a 4-month history of increasing knee pain. A plain radiograph of the knee is shown (Slide 1) and a technetium bone scan (Slide 2). The low- and high-power hematoxylin/eosin sections of the biopsy are presented (Slide 3 and Slide 4).
The most likely diagnosis based on the age of the patient, location of the tumor, and the radiographic images with the biopsy material is:

1) Osteomyelitis
3) High-grade intramedullary osteosarcoma
2) Eosinophilic granuloma
5) Nonossifying fibroma
4) Ewing tumor

The radiograph shows the classic appearance of osteogenic sarcoma in adolescents: metaphyseal location, bone destruction and bone formation, and a mineralized soft tissue mass. The histologic sections show a malignant stroma of spindle cells producing osteoid.Correct Answer: High-grade intramedullary osteosarcoma

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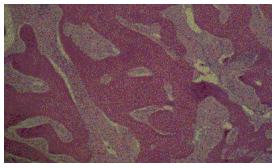
3594. (944) Q9-1235:

Slide 1

Slide 2



Slide 3

Slide 4

Slide 5

A 30-year-old woman has a painless mass in the back of her knee. She has felt the mass for over six months. She has restricted range of motion in the knee and is now having difficulty when she walks. The plain radiographs are shown (Slide 1 and Slide 2). The low- and high-power histologic hematoxylin/eosin sections are also presented (Slide 3, Slide 4 and Slide 5). Based upon the history, physical examination, plain radiographs, and biopsy the most likely diagnosis is:

1) Heterotopic ossification
3) High-grade intramedullary osteosarcoma
2) Osteochondroma
5) Periosteal osteosarcoma
4) Parosteal osteosarcoma

The plain radiographs show a heavily mineralized lesion on the surface of the bone. The mass encircles the bone. Note the prominent bone formation. The low-power histologic section shows prominent bone formation and fibrous components. The high-power section shows a spindle cell tumor with prominent fibrous tissue production. The spindle cells are uniform in appearance . The nuclei lack pleomorphism. This is a parosteal osteosarcoma.Correct Answer: Parosteal osteosarcoma

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3595. (945) Q9-1236:

Slide 1

A 40-year-old man injures his knee sliding into second base while playing baseball. The radiograph of the knee shows a lesion in the distal femur (Slide 1). Prior to the accident, he had no pain and is otherwise healthy. He is now asymptomatic. The most likely diagnosis based on the plain radiograph is:

1) Dedifferentiated chondrosarcoma
3) Osteochondroma
2) Low-grade intramedullary chondrosarcoma
5) Enchondroma
4) Chondroblastoma

Enchondromas are cartilage tumors that are usually inactive in adults. They usually do not grow or cause any symptoms. They are intramedullary lesions and one can recognize their characteristic matrix mineralization: stipples and rings.Correct Answer: Enchondroma

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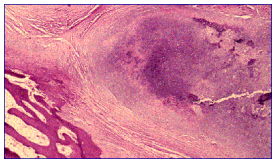
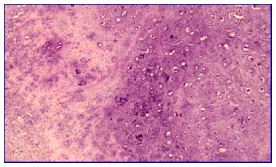
3596. (946) Q9-1237:





Slide 1 **Slide 2** **Slide 3**

A 20-year-old man bangs his shoulder while playing ice hockey one week ago, and now he has pain and a mass over the deltoid area. A plain radiograph is shown (Slide 1). An open biopsy is performed and the low- and high-power sections are presented (Slide 2 and Slide 3).
The most likely diagnosis based on the radiographic features and biopsy is:

1) Osteochondroma
3) Heterotopic ossification
2) Low-grade intramedullary chondrosarcoma
5) Periosteal chondroma
4) Parosteal osteosarcoma

Periosteal chondroma is an uncommon surface cartilage tumor. The lesion is usually small (3 cm to 5 cm) and rests in a saucer-shaped depression on the surface of the bone. Characteristic locations include the proximal humerus and distal femur. Histologically, the lesion is composed of lobules of cartilage. Although this tumor is benign, the lesion is usually hyper cellular and there may be prominent atypia of the cartilage cells. The treatment is excion with a marginal margin.Correct Answer: Periosteal chondroma

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3597. (947) Q9-1238:

Slide 1

A 16-year-old girl has a painless bump behind her knee. However, she does have pain if she her leg is hit while playing soccer. On physical examination there is a firm lump behind the knee. A plain radiograph of the knee is shown (Slide 1).
The most likely diagnosis based on the history, physical examination and plain radiograph is:

1) High-grade intramedullary osteosarcoma
3) Periosteal osteosarcoma
2) Parosteal osteosarcoma
5) Periosteal chondroma
4) Osteochondroma

Osteochondromas have a characteristic radiographic appearance. The lesion is a surface tumor and the medullary cavity of the normal bone flows into the osteochondroma. Some authors call this "cortical sharing." Osteochondromas may have a well defined stalk (pedunculated osteochondroma) or they may have a broad base as in this case (sessile osteochondroma). This diagnosis can be made with the plain radiographs without histologic confirmation.Correct Answer: Osteochondroma

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3598. (948) Q9-1239:

Paget disease is a primary disorder of:

1) Epiphyseal plate
3) Synovial membrane
2) Articular cartilage
5) Intravertebral disc
4) Bone

Paget disease is a primary disorder of bone. Paget disease is a remodeling disease of bone. There is abnormal increased activity of the osteoclast. The osteoclast resorbs the bone resulting in lysis and the osteoblast lays down new bone in thickened trabeculae and cortices. The treatment of Paget's disease of bone is stopping the osteoclasts. Anti-pagetic medications include the diphosphonate class of medications.Correct Answer: Bone

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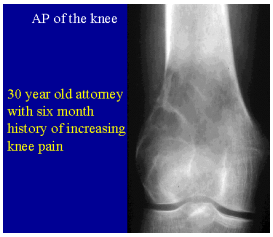
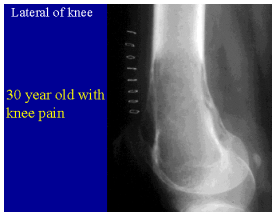
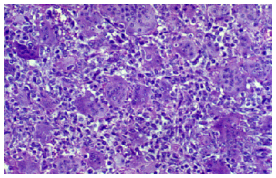
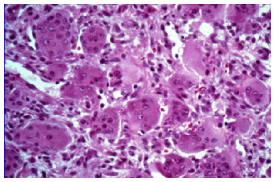
3599. (949) Q9-1240:









Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 30-year-old attorney has a 6-month history of increasing knee pain. His pain occurs both with activity and at rest. He is otherwise healthy. Laboratory studies show a normal complete blood count, sedimentation rate, and chemistry values (including normal calcium and phosphorus levels). Anteroposterior and lateral radiographs are shown (Slide 1 and Slide 2). The low- and high-power hematoxylin and eosin sections are shown (Slide 3 and Slide 4).
The diagnosis, based on the history, laboratory values, radiographs, and biopsy sections, most likely is:

1) Telangiectatic osteosarcoma
3) Hyperparathyroidism
2) Osteomyelitis
5) Aneurysmal bone cyst
4) Giant cell tumor

The radiograph shows purely lytic bone destruction that fills the lateral metaphysis and extends to the articular surface. The lateral cortex is very thin and almost completely destroyed. The histologic sections show collection of giant cells and mononuclear cells. Notice that the giant cells are uniformly scattered throughout the histologic section on the low power, in contrast to chondroblastoma where the giant cells are scattered throughout the mononuclear cells and that the nuclei of the mononuclear cells are the same as the nuclei of the giant cells.Correct Answer: Giant cell tumor

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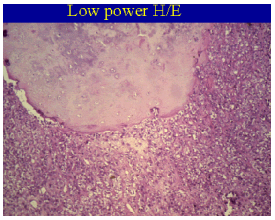
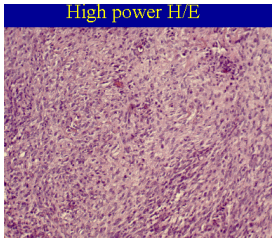
3600. (950) Q9-1243:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man presents with a 6-month history of increasing knee and distal thigh pain. He is otherwise healthy and has no history of prior malignancies. He has discomfort at night and at rest. The plain radiograph of the lesion is shown (Slide 1), and low and high power histologic sections from an open biopsy are shown (Slide 2 and Slide 3).
The most likely diagnosis based on the history, plain radiographs, and biopsy material is:

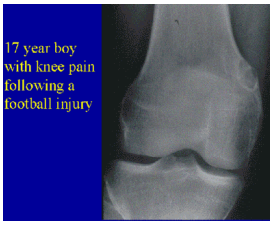
1) Bone infarct
3) Lymphoma
2) Enchondroma
5) Metastatic bone disease
4) Dedifferentiated chondrosarcoma

Dedifferentiated chondrosarcomas are high-grade cartilage tumors that are bimorphic (two distinct histologic components). Alongside the very low-grade cartilage tumor are areas of high-grade spindle cell sarcoma. The cartilage component is very low grade (grade Â½, grade 1, or grade 2), while the high-grade component is an anaplastic spindle cell sarcoma; either osteosarcoma, fibrosarcoma, or malignant fibrous histiocytoma. The radiographs also reflect the histologic bimorphic component; area typical for low-grade chondrosarcoma with superimposed aggressive area. The aggressive component is usually represented by an area of:

- Lytic bone destruction
- Cortical bone erosion or typically destruction
- Soft tissue mass

Correct Answer: Dedifferentiated chondrosarcoma

3601. (951) Q9-1244:



Slide 1

A 17-year-old boy hurt his knee when he was tackled during a football game. He has a large effusion and experiences difficulty in walking. A plain radiograph of the knee is shown (Slide 1).
The most likely diagnosis based on the plain radiograph is:

1) High-grade intramedullary osteosarcoma
3) Chondroblastoma
2) Giant cell tumor
5) Fibrous cortical defect
4) Ewing tumor

Fibrous cortical defects are cortically based, small metaphyseal lesions. They have a sclerotic rim with a lucent center. The lesions do not cause symptoms, and no treatment is necessary.Correct Answer: Fibrous cortical defect

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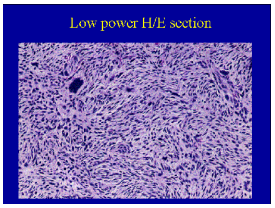
3602. (952) Q9-1246:



Slide 1 **Slide 2**

A 55-year-old man presented with a 4-month history of severe knee pain. The plain anteroposterior radiograph of the knee is shown (Slide 1). He has pain both at rest and at night. A staging evaluation was performed to determine of this was a metastatic lesion. A chest radiograph, chest computed tomography (CT) scan, and an abdominal CT scan were all negative. Serum studies showed a normal complete blood cell count, differential, chemistry group, and serum electrophoresis. A biopsy was performed and is shown (Slide 2).
The most likely diagnosis is:

1) Metastatic bone disease
3) Lymphoma
2) Multiple myeloma
5) Malignant fibrous histiocytoma
4) Fibrosarcoma

The radiographics show a destructive lesion with a mottled appearance: a mixture of bone destruction and bone formation. The biopsy specimen shows the characteristic features of malignant fibrous histiocytoma: a storiform pattern, histiocytes, and bizarre giant cells.Correct Answer: Malignant fibrous histiocytoma

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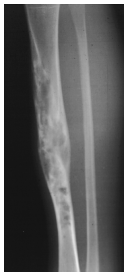
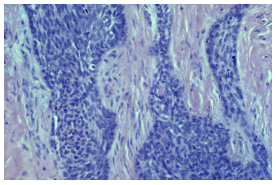
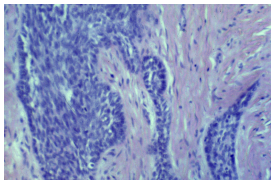
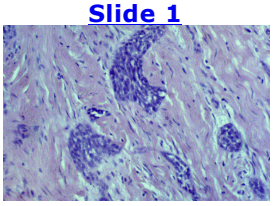
3603. (953) Q9-1247:







Slide 1 **Slide 2** **Slide 3** **Slide 4**



Slide 5

A 30-year-old man presents with an 18-month history of pain in his leg. The pain is over the mid-section of the tibia and occurs both at rest and activity. There no history of trauma or infections. The plain radiographs are shown (Slide 1 and Slide2) and a biopsy of the lesion is shown (Slide 3, Slide 4 and Slide 5).
The most likely diagnosis based on the clinical findings, plain radiographs, and biopsy specimens is:

1) Osteomyelitis
3) Fibrous dysplasia
2) High-grade intramedullary osteosarcoma
5) Adamantinoma
4) Osteofibrous dysplasia

Adamantinoma most commonly occurs in the tibia and has multiple areas of bone destruction. There is often intervening bone sclerosis between the areas of bone destruction. The biopsy specimens shows the typical features of adamantinoma: epithelial cells in fibrous stroma.Correct Answer: Adamantinoma

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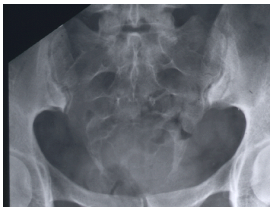
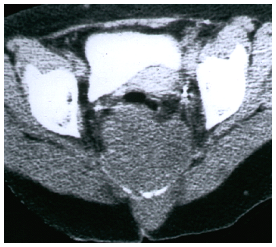
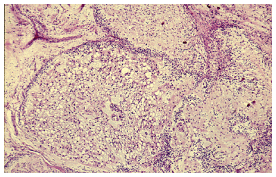
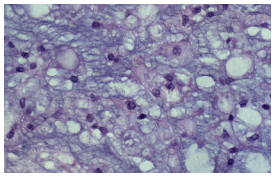
3604. (954) Q9-1248:









Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 55-year-old man presented with a 12-month history of increasing low back pain. He experiences pain during the night and often has difficulty sitting. He has also noticed that in the last 9 months constipation has become an increasing problem. The plain radiographs and computerized tomography (CT) scan are shown (Slide 1 and Slide 2). Low- and high-power histologic sections are also presented (Slide 3 and Slide 4).
The most likely diagnosis is:

1) Metastatic adenocarcinoma
3) Malignant fibrous histiocytoma
2) Multiple myeloma
5) Sacral insufficiency fracture
4) Chordoma

The classic midline bone destruction with an anterior soft tissue mass is present. The histology shows a lobular pattern of growth and the characteristic physaliferous cells can be seen on high power.Correct Answer: Chordoma

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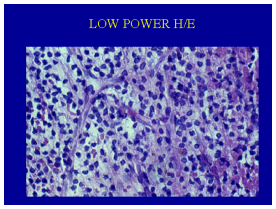
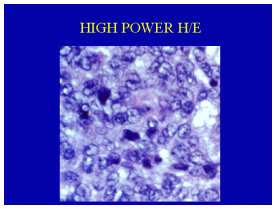
3605. (955) Q9-1249:





Slide 1 **Slide 2** **Slide 3**

A 25-year-old man has a 4-month history of severe thigh and knee pain. He has pain both at rest and at night. He has tenderness on palpation of the thigh. He has been febrile and has an elevated white blood cell count. The anteroposterior and lateral radiographs of the femur are shown (Slide1). The high and lower power histologic sections are also shown (Slide 2) and (Slide 3).
The most likely diagnosis is:

1) Osteogenic sarcoma
3) Malignant fibrous histiocytoma
2) Osteomyelitis
5) Ewing sarcoma
4) Fibrosarcoma

The histologic features of Ewing tumor include a monotonous blue cell tumor, indistinct cell borders, and no matrix production by the tumor cells.Correct Answer: Ewing sarcoma

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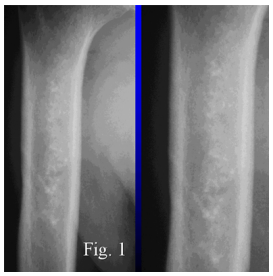
3606. (1071) Q9-1429:



Slide 1 **Slide 2** **Slide 3**

A 50-year-old man has a lesion in the left humerus that is discovered during a routine annual physical examination. The plain radiographs (Slide 1) and the coronal T1- and T2-weighted images (Slides 2 and 3) are presented. The most likely diagnosis based on the plain radiographs and magnetic resonance imaging scan is:

1) Low grade chondrosarcoma
3) Pagetâs disease
2) Enchondroma
5) Multiple myeloma
4) Metastatic carcinoma

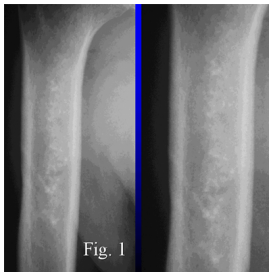
The plain radiographs show a mineralized lesion in the medullary cavity. The mineralization shows stipples and small rings. This pattern is consistent with a cartilage lesion. There are no cortical changes indicating that the lesion is inactive. The magnetic resonance imaging scan shows a lesion with a low signal on the T1-weighted image and high signal on the T2-weighted image. There is no marrow edema bordering the lesion on the T2-weighted image. **All of these features are compatible with the diagnosis of an enchondroma.** Chondrosarcomas in long bones have easily recognized features: large cortical erosions, cortical destruction, cortical thickening, and a soft tissue mass.

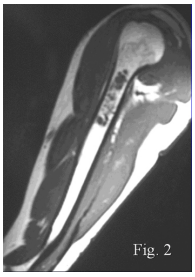
The other possible answers cover lesions with characteristic radiographic features:

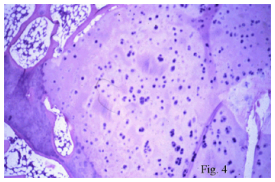
- Pagetâs disease: Coarsened trabeculae and thickened cortices
- Metastatic carcinoma: Lytic lesion with cortical bone destruction
- Multiple myeloma: Purely lytic punched-out lesion that may be in a single or multiple areas

Correct Answer: Enchondroma

3607. (1072) Q9-1430:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 50-year-old man has a lesion in the left humerus that is discovered during a routine annual physical examination. The plain radiographs (Slide 1), the coronal T1- and T2-weighted images (Slides 2 and 3), and a biopsy (Slide 4) are presented. The most appropriate treatment method is:

1) Observation with repeat radiograph in 3 to 6 months
3) Systemic chemotherapy and external beam radiation to the humerus
2) Wide surgical resection and custom prosthetic reconstruction
5) Curettage, rod fixation, and external beam irradiation
4) External beam irradiation alone to the humerus

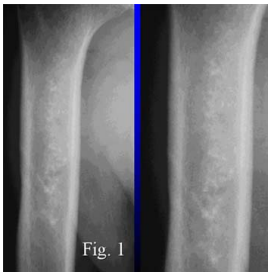
The plain radiographs show a mineralized lesion in the medullary cavity. The mineralization shows stipples and small rings. This pattern is consistent with a cartilage lesion. There are no cortical changes indicating that the lesion is inactive. The magnetic resonance imaging scan shows a lesion with a low signal on the T1-weighted image and high signal on the T2-weighted image. There is no marrow edema bordering the lesion on the T2-weighted image**. All of these features are compatible with the diagnosis of an enchondroma.** Chondrosarcomas in long bones have easily recognized features: large cortical erosions, cortical destruction, cortical thickening, and a soft tissue mass.

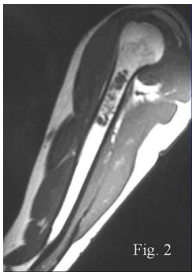
The biopsy shows a cartilage lesion. There is no permeation of the trabecular bone. Both the plain radiographs and biopsy specimen are consistent with the diagnosis of an enchondroma.

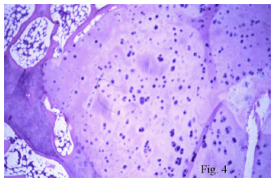
Enchondromas are treated with observation and repeat radiographs in 3 to 6 months.

Correct Answer: Observation with repeat radiograph in 3 to 6 months

3608. (1073) Q9-1431:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 50-year-old man has a lesion in the left humerus that is discovered during a routine annual physical examination. The plain radiographs (Slide 1), the coronal T1- and T2-weighted images (Slides 2 and 3), and a biopsy (Slide 4) are presented. The correct stage of this lesion according to the Musculoskeletal Tumor Society is:

1) Stage I
3) Stage III
2) Stage II
5) Stage 2
4) Stage 1

The plain radiographs show a mineralized lesion in the medullary cavity. The mineralization shows stipples and small rings. This pattern is consistent with a cartilage lesion. There are no cortical changes indicating that the lesion is inactive. The magnetic resonance imaging scan shows a lesion with a low signal on the T1-weighted image and high signal on the T2-weighted image. There is no marrow edema bordering the lesion on the T2-weighted image. **All of these features are compatible with the diagnosis of an enchondroma.** Chondrosarcomas in long bones have easily recognized features: large cortical erosions, cortical destruction, cortical thickening, and a soft tissue mass.

Enchondromas are almost always inactive and asymptomatic. Therefore, enchondromas are Stage 1 inactive lesions.

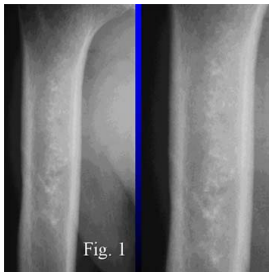
Remember:

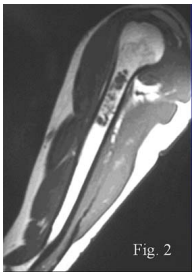
Stage 1 Latent, inactive
Stage 2 Active
Stage 3 Aggressive

Stage I Low grade
Stage II High grade
Stage III Metastatic disease

Correct Answer: Stage 1

3609. (1074) Q9-1432:





Slide 1 **Slide 2** **Slide 3**

A 50-year-old man has a lesion in the left humerus that was discovered during a routine annual physical examination. The plain radiographs (Slide 1) and the coronal T1- and T2-weighted images (Slides 2 and 3) are presented. The area of mineralization in the medullary cavity marked by the arrow in Figure 1 is most likely:

1) Normal marrow which has calcified
3) Areas of metastatic carcinoma
2) Hyaline cartilage which has calcified
5) Fibrous replacement of the marrow
4) Reactive bone formation

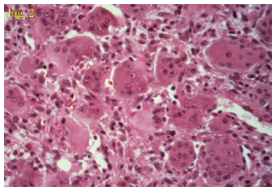
The plain radiographs show a mineralized lesion in the medullary cavity. The mineralization shows stipples and small rings. This pattern is consistent with a cartilage lesion. There are no cortical changes indicating that this lesion is active. The magnetic resonance imaging scan shows a lesion with a low signal on the T1-weighted image and a high signal on the T2-weighted image. The high signal on the T2-weighted image is reflective of the high water content of cartilage lesions. There is no marrow edema bordering the lesion on the T2-weighted image. **All of these features are consistent with the diagnosis of an enchondroma.**

The other possible answers are wrong for a variety of reasons:

- Normal marrow does not calcify.
- Metastatic carcinoma will show lytic features.
- Reactive bone formation shows cloud-like mineralization, and the bone is low signal on T1- and T2-weighted images.
- When the marrow is replaced by fibrous tissue, there will not be any mineralization.

Correct Answer: Hyaline cartilage which has calcified

3610. (1075) Q9-1434:



Slide 1 **Slide 2**

A 29-year-old woman has a 5-month history of dull, aching pain in her shoulder after falling from her bicycle. Her radiograph (Slide 1) and biopsy specimen (Slide 2) are presented. The most likely diagnosis is:

1) Telangiectatic osteosarcoma
3) Giant cell tumor
2) Aneurysmal bone cyst
5) Ewing tumor
4) Unicameral bone cyst

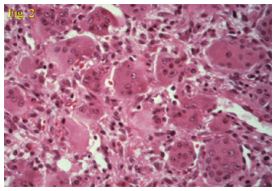
The plain radiographs show a destructive lytic lesion. The differential diagnosis, based on the patientâs age and the pattern of bone destruction, is:

- Giant cell tumor
- Aneurysml bone cyst
- Telangiectatic osteosarcoma
- Ewing tumor

The histology clearly shows a giant cell tumor with uniformly distributed giant cells in a field of mononuclear cells. **The diagnosis is giant cell tumor**.

Correct Answer: Giant cell tumor

3611. (1076) Q9-1435:



Slide 1 **Slide 2**

A 29-year-old woman has a 5-month history of dull, aching pain in her shoulder after falling from her bicycle. Her radiograph (Slide 1) and biopsy specimen (Slide 2) are presented. Which of the following is the most appropriate treatment regimen:

1) Preoperative multiagent chemotherapy followed by wide resection
3) Wide resection followed by external beam irradiation
2) Internal fixation and external beam irradiation
5) Forequarter amputation
4) Marginal resection followed by joint reconstruction

The plain radiographs show a destructive lytic lesion. The differential diagnosis, based on the patientâs age and the pattern of bone destruction, is:

- Giant cell tumor
- Aneurysml bone cyst
- Telangiectatic osteosarcoma
- Ewing tumor

The histology clearly shows a giant cell tumor with uniformly distributed giant cells in a field of mononuclear cells. **The diagnosis is giant cell tumor.**

The treatment of giant cell tumor is curettage with methylmethacrylate augmentation for lesions in which the joint surfaces can be saved. If the joint surfaces cannot be saved, marginal resection and joint reconstruction must then be performed. Joint reconstruction in this case may be either with an osteoarticular allograft, allograft prosthetic composite, or a metal prosthesis.

Correct Answer: Marginal resection followed by joint reconstruction

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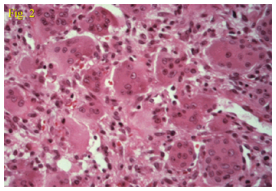
3612. (1077) Q9-1436:



Slide 1 **Slide 2**

A 29-year-old woman has a 5-month history of dull, aching pain in her shoulder after falling from her bicycle. Her radiograph (Slide 1) and biopsy specimen (Slide 2) are presented. The stage of this lesion according to the Musculoskletal Tumor Society would be:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

The plain radiographs show a destructive lytic lesion. The differential diagnosis, based on the patientâs age and the pattern of bone destruction, is:

- Giant cell tumor
- Aneurysml bone cyst
- Telangiectatic osteosarcoma
- Ewing tumor

The histology clearly shows a giant cell tumor with uniformly distributed giant cells in a field of mononuclear cells. **The diagnosis is giant cell tumor.**

This tumor is aggressive and has destroyed the entire metaphysis, resulting in a fracture. The epiphysis is also completely destroyed. This is an aggressive lesion and would be classified as a Stage 3 aggressive lesion.

Remember that Arabic numerals are for benign lesions and Roman numerals are for malignant lesions.

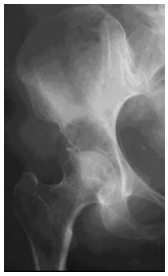
Remember:

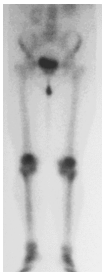
- Stage 1 Inactive/latent
- Stage 2 Active
- Stage 3 Aggressive

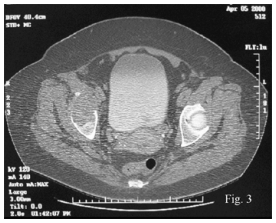
- Stage I Low grade
- Stage II High grade
- Stage III Metastatic disease

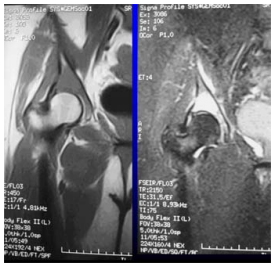
Correct Answer: Stage 3

3613. (1078) Q9-1437:

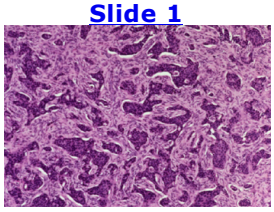


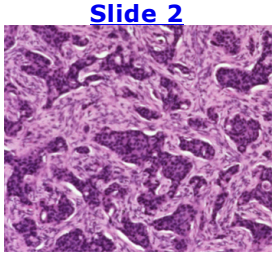






Slide 1 Slide 2 Slide 3 Slide 4





Slide 5 Slide 6

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs (Slide 1), technetium bone scan (Slide 2), computerized tomography scan (Slide 3), and coronal T1- and T2-weighted magnetic resonance images (Slide 4) are presented. A needle biopsy is also performed (Slides 5 and 6). The most likely diagnosis is:

1) Metastatic adenocarcinoma
3) Lymphoma
2) Multiple myeloma
5) Malignant fibrous histiocytoma
4) Chondrosarcoma

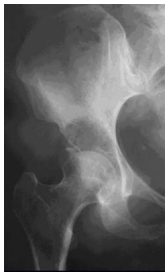
The plain radiographs show a purely lytic destructive lesion that is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is suggestive of a malignancy. The magnetic resonance image shows a lesion that is homogenously low on T1-weighted images and high on T2-weighted images. Surgeons cannot make a definitive diagnosis based upon the radiographic features. The most common malignancies in this age group are:

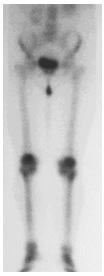
1. Metastatic bone disease
2. Multiple myeloma
3. Lymphoma
4. Chondrosarcoma
5. Malignant fibrous histiocytoma

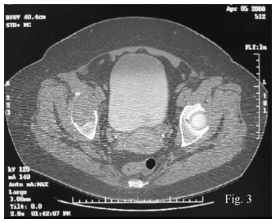
The biopsy specimen shows round, epithelial-like cells that are grouped in clusters. The cells are arranged in a fibrous background. **The diagnosis is metastatic bone disease**.

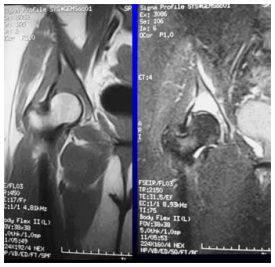
Correct Answer: Metastatic adenocarcinoma

3614. (1079) Q9-1438:

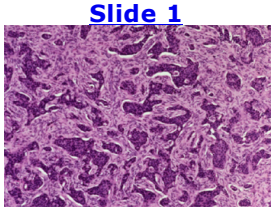


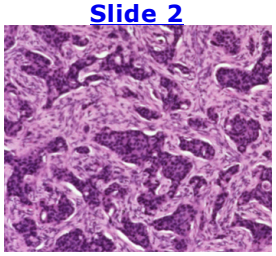






[Slide 1](#) [Slide 2](#) [Slide 3](#) [Slide 4](#)





[Slide 5](#) [Slide 6](#)

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs (Slide 1), technetium bone scan (Slide 2), computerized tomography scan (Slide 3), and coronal T1- and T2-weighted magnetic resonance images (Slide 4) are presented. A needle biopsy is also performed (Slides 5 and 6). Which of the following treatment regimens would be the most appropriate:

1) Wide resection and allograft acetabular reconstruction
3) Preoperative chemotherapy followed by wide resection
2) Internal hemipelvectomy alone
5) Hemipelvectomy
4) Acetabular reconstruction followed by external beam irradiation

The plain radiographs show a purely lytic destructive lesion that is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is suggestive of a malignancy. The magnetic resonance image shows a lesion that is homogenously low on T1-weighted images and high on T2-weighted images. Surgeons cannot make a definitive diagnosis based upon the radiographic features. The most common malignancies in this age group are:

1. Metastatic bone disease
2. Multiple myeloma
3. Lymphoma
4. Chondrosarcoma
5. Malignant fibrous histiocytoma

The biopsy specimen shows round, epithelial-like cells that are grouped in clusters. The cells are arranged in a fibrous background. **The diagnosis is metastatic bone disease**.

The treatment of metatastic bone disease is either internal fixation with postoperative external beam irradiation or external beam irradiation alone. In this case, there is extensive destruction and fracture is imminent. The treatment of choice is acetabular reconstruction followed by external beam irradiation.

Correct Answer: Acetabular reconstruction followed by external beam irradiation

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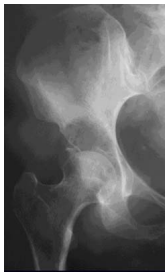
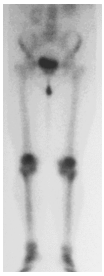
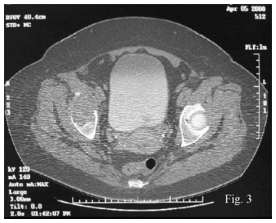
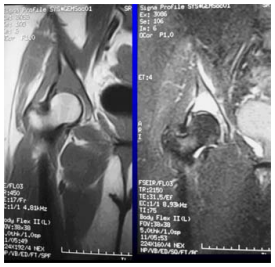
3615. (1080) Q9-1439:









Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs (Slide 1), technetium bone scan (Slide 2), computerized tomography scan (Slide 3), and coronal T1- and T2-weighted magnetic resonance images (Slide 4) are presented. The most likely diagnosis based upon the radiographs would be:

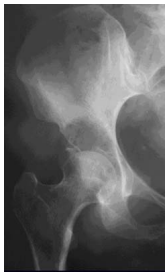
1) Septic arthritis
3) Stress fracture
2) Osteomyelitis of the acetabulum
5) Malignant neoplasm
4) Lytic phase of Pagetâs disease

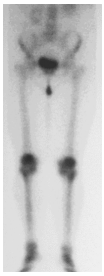
The plain radiographs show a purely lytic destructive lesion that is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is suggestive of a malignancy. The magnetic resonance image shows a lesion that is homogenously low on T1-weighted images and high on T2-weighted images. Surgeons cannot make a definitive diagnosis based upon the radiographic features. The most common malignancies in this age group are:

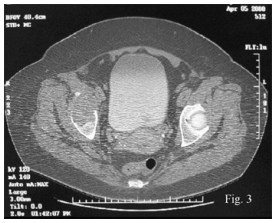
1. Metastatic bone disease
2. Multiple myeloma
3. Lymphoma
4. Chondrosarcoma
5. Malignant fibrous histiocytoma

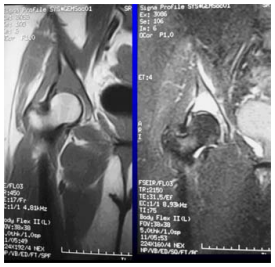
Correct Answer: Malignant neoplasm

3616. (1081) Q9-1440:

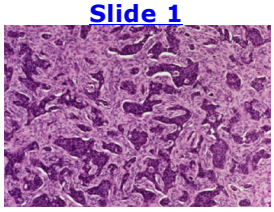




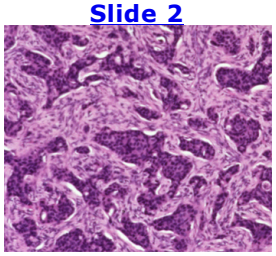




[Slide 1](#)



[Slide 2](#)



[Slide 3](#)

[Slide 4](#)

[Slide 5](#)

[Slide 6](#)

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs (Slide 1), technetium bone scan (Slide 2), computerized tomography scan (Slide 3), and coronal T1- and T2-weighted magnetic resonance images (Slide 4) are presented. A needle biopsy is also performed (Slides 5 and 6). The cells directly responsible for the bone destruction are:

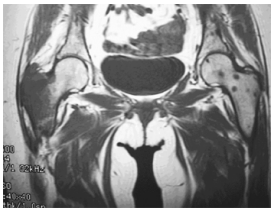
1) Tumor cells
3) Fibroblasts
2) Plasma cells
5) Mast cells
4) Osteoclasts

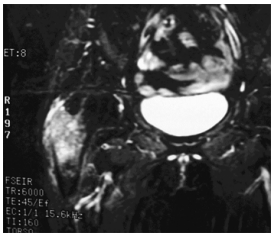
The plain radiographs show a purely lytic destructive lesion that is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is suggestive of a malignancy. The magnetic resonance image shows a lesion that is homogenously low on T1-weighted images and high on T2-weighted images. Surgeons cannot make a definitive diagnosis based upon the radiographic features; however, it is likely that this lesion is malignant. The biopsy specimen shows round, epithelial-like cells that are grouped in clusters. The cells are arranged in a fibrous background. **The diagnosis is metastatic bone disease**.

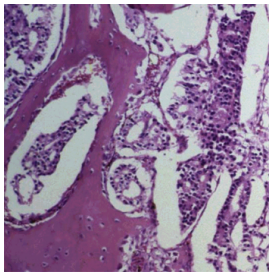
The bone destruction in metastatic bone disease is a direct result of osteoclastic resorption of the bone. The metastatic breast cells secrete a factor that activates and recruits osteoclasts that destroy the bone. Diphosphonate therapy (usually intravenous pamidronate) is given to virtually all women with metatstatic breast carcinoma to stop the osteoclasts from resorbing the bone matrix.

Correct Answer: Osteoclasts

3617. (1082) Q9-1441:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

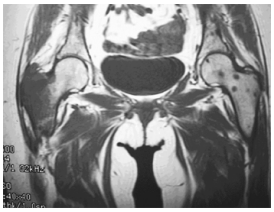
A 65-year-old woman has a 5-month history of increasing hip and thigh pain. Her plain radiographs (Slide 1) and T1- and T2-weighted coronal images (Slides 2 and 3) of her hip are presented. A biopsy is also performed (Slide 4). The most likely diagnosis is:

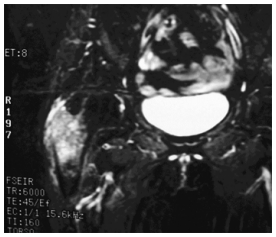
1) Multiple myeloma
3) Metastatic adenocarcinoma
2) Lymphoma
5) Pagetâs disease
4) Chondrosarcoma

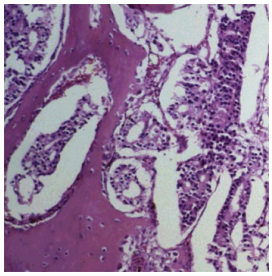
The plain radiographs show an ill-defined permeative lesion in the proximal femur. The lateral cortex of the greater trochanter is thinned. The T1-weighted coronal images show a low-signal lesion in the entire greater trochanter extending to the base of the femoral neck. In the opposite proximal femur and acetabulum, there are multiple small low-signal lesions consistent with metastatic bone disease. The T2-weighted images show a very high-signal area in the greater trochanter. The inversion recovery image is sensitive to pathologic processes. Normal marrow will be low signal and pathologic lesions are high signal. The biopsy shows round epithelial cells forming glands. **This pattern is characteristic of metastatic adenocarcinoma**.

Correct Answer: Metastatic adenocarcinoma

3618. (1083) Q9-1442:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has a 5-month history of increasing hip and thigh pain. She has severe pain with weight bearing on the right leg. Her plain radiographs (Slide 1) and T1- and T2-weighted coronal images (Slides 2 and 3) of her hip are presented. A biopsy is also performed (Slide 4). The most appropriate treatment would be:

1) Hip disarticulation
3) Wide resection and custom proximal femoral replacement
2) Neck exploration and removal of her parathyroid glands
5) Internal fixation followed by external beam irradiation
4) Crutch ambulation for 6 to 8 weeks

The plain radiographs show an ill-defined permeative lesion in the proximal femur. The lateral cortex of the greater trochanter is thinned. The T1-weighted coronal images show a low-signal lesion in the entire greater trochanter extending to the base of the femoral neck. In the opposite proximal femur and acetabulum, there are multiple small low-signal lesions consistent with metastatic bone disease. The T2-weighted images show a very high-signal area in the greater trochanter. The inversion recovery image is sensitive to pathologic processes. Normal marrow will be low signal and pathologic lesions are high signal. The biopsy shows round epithelial cells forming glands. **This pattern is characteristic of metastatic adenocarcinoma**.

The treatment of metastatic breast carcinoma of bone is external beam irradiation to symptomatic lesions and diphosphonate therapy to retard the bone loss. Internal fixation is performed to prevent pathologic fracture. When patients have significant weight bearing pain and a purely lytic lesion in the hip, the risk of fracture is high. The best treatment method for this patient is internal fixation followed by external beam irradiation.

Correct Answer: Internal fixation followed by external beam irradiation

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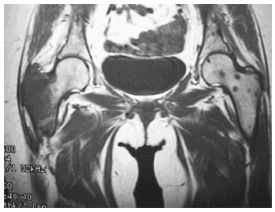
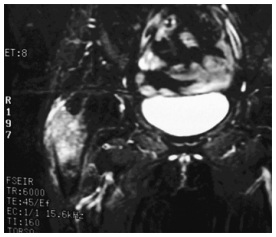
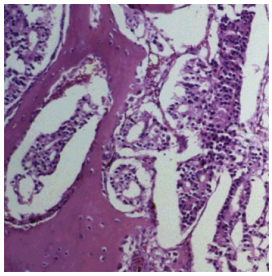
3619. (1084) Q9-1443:

Slide 1 Slide 2 Slide 3 Slide 4

A 65-year-old woman has a 5-month history of increasing hip and thigh pain. She has severe pain with weight bearing on the right leg. Her plain radiographs (Slide 1) and T1- and T2-weighted coronal images (Slides 2 and 3) of her hip are presented. A biopsy is also performed (Slide 4). The cells directly responsible for the bone destruction are:

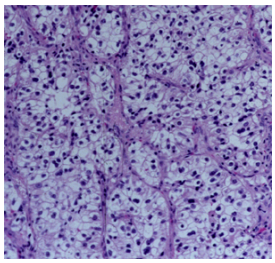
1) A. Tumor cells
3) C. Osteoclasts
2) B. Fibroblasts
5) E. Plasma cells
4) D. Histiocytes

The plain radiographs show an ill-defined permeative lesion in the proximal femur. The lateral cortex of the greater trochanter is thinned. The T1-weighted coronal images show a low-signal lesion in the entire greater trochanter extending to the base of the femoral neck. In the opposite proximal femur and acetabulum, there are multiple small low-signal lesions consistent with metastatic bone disease. The T2-weighted images show a very high-signal area in the greater trochanter. The inversion recovery image is sensitive to pathologic processes. Normal marrow will be low signal and pathologic lesions are high signal. The biopsy shows round epithelial cells forming glands. **This pattern is characteristic of metastatic adenocarcinoma**.

The bone destruction in metastatic bone disease is a direct result of osteoclastic resorption of the bone. The metastatic breast cells secrete a factor that activates and recruits osteoclasts that destroy the bone. Diphosphonate therapy (usually intravenous pamidronate) is given to virtually all women with metastatic breast carcinoma to stop the osteoclasts from resorbing the bone matrix.

Correct Answer: C. Osteoclasts

3620. (1085) Q9-1444:



Slide 1 Slide 2

A 45-year-old man has a 4-month history of severe pain in his shoulder. His plain radiograph (Slide 1) and biopsy (Slide 2) are presented. The most likely diagnosis is:

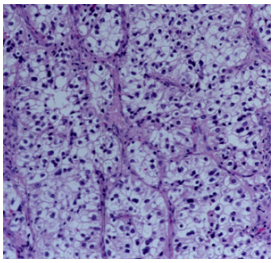
1) Malignant fibrous histiocytoma
3) Multiple myeloma
2) Pagetâs disease
5) Hyperparathyroidism (brown tumor)
4) Metastatic adenocarcinoma

The plain radiograph shows a destructive and purely lytic lesion. More than 50% of the cortical bone has been destroyed. This pattern of permeative bone destruction is consistent with a malignancy. The biopsy shows round, epithelial-like cells with clear cytoplasm. The cells are organized in clusters. **This is metastatic clear cell carcinoma of the kidney**.

This patient is prone to fracture. The humeral lesion meets the criteria of an impending fracture.

Correct Answer: Metastatic adenocarcinoma

3621. (1086) Q9-1445:



Slide 1 **Slide 2**

A 45-year-old man has a 4-month history of severe pain in his shoulder. His plain radiograph (Slide 1) and biopsy (Slide 2) are presented. The most appropriate treatment method is:

1) Shoulder disarticulation
3) External beam irradiation
2) Wide resection and allograft reconstruction
5) Neck exploration and parathyroidectomy
4) Internal fixation with external beam irradiation

The plain radiograph shows a destructive and purely lytic lesion. More than 50% of the cortical bone has been destroyed. This pattern of permeative bone destruction is consistent with a malignancy. The biopsy shows round, epithelial-like cells with clear cytoplasm. The cells are organized in clusters. **This is metastatic clear cell carcinoma of the kidney**.

This patient is prone to fracture. The humeral lesion meets the criteria of an impending fracture. The best treatment is internal fixation with an intramedullary rod and postoperative external beam irradiation. Plate fixation with methylmethacrylate supplementation would be another reasonable choice.

Correct Answer: Internal fixation with external beam irradiation

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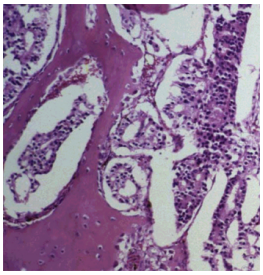
3622. (1087) Q9-1446:



Slide 1 **Slide 2**

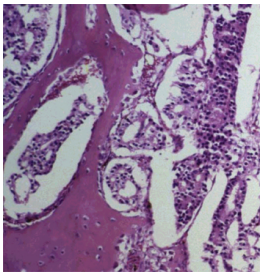
A 70-year-old man has severe shoulder pain. A plain radiograph (Slide 1) and a biopsy specimen (Slide 2) are presented. The most likely diagnosis is:

1) Multiple myeloma
3) Bone island (enostosis)
2) Pagetâs disease
5) Osteosarcoma occurring in Pagetâs disease
4) Metastatic carcinoma

The plain radiograph of the humerus shows a densely sclerotic lesion. The cortices are intact and show no thickening or remodeling features that are characteristic of Pagetâs disease. The lesion has no apparent bone destruction. The biopsy specimen shows epithelial cells formed in clusters (or an organoid pattern). **This is metastatic carcinoma**.

Correct Answer: Metastatic carcinoma

3623. (1088) Q9-1447:



Slide 1 **Slide 2**

A 70-year-old man has severe shoulder pain. A plain radiograph (Slide 1) and a biopsy specimen (Slide 2) are presented. The most appropriate treatment for the humeral lesion is:

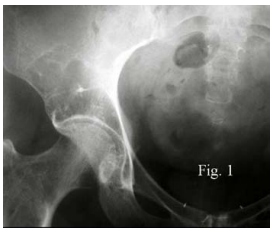
1) Wide resection and allograft prosthetic reconstruction
3) Intramedullary rod fixation and external beam irradiation
2) Diphosphonate therapy
5) External beam irradiation
4) Subacromial cortisone injection

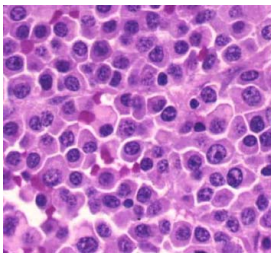
The plain radiograph of the humerus shows a densely sclerotic lesion. The cortices are intact and show no thickening or remodeling features that are characteristic of Pagetâs disease. The lesion has no apparent bone destruction. The biopsy specimen shows epithelial cells formed in clusters (or an organoid pattern). **This is metastatic carcinoma**.

The goals of treatment in metastatic disease are to relieve pain, prevent fracture, and maintain function. Purely blastic lesions have a low risk of fracture. This patient does not need prophylactic fixation. The best treatment choice is external beam irradiation alone.

Correct Answer: External beam irradiation

3624. (1132) Q9-1493:





Slide 1 **Slide 2**

A 66-year-old man has a 4-month history of hip discomfort. The plain radiographs are shown in Slide 1 and a biopsy is shown in Slide 2. The most likely diagnosis is:

1) Metastatic bone disease
3) Multiple myeloma
2) Lymphoma
5) Malignant fibrous histiocytoma
4) Chondrosarcoma

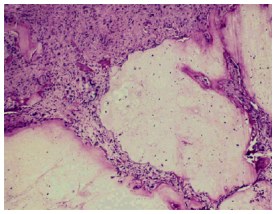
The plain radiograph of the pelvis shows a lytic lesion in the supra-acetabular area. A destructive lesion in the pelvis may be secondary to five common processes in patients who are 40 to 80 years of age, including metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma. Often a biopsy is necessary to establish the diagnosis. The biopsy specimen shows plasma cells. The plasma cells have these characteristics:

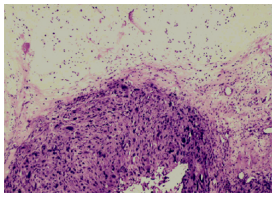
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

The diagnosis is multiple myeloma. The treatment would be external beam irradiation.

Correct Answer: Multiple myeloma

3625. (1133) Q9-1496:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man has a 6-month history of increasing knee pain. He has discomfort at night and at rest. His anteroposterior and lateral radiographs are shown in Slide 1, and low and high power biopsy specimens are shown in Slides 2 and 3. The most likely diagnosis is:

1) Metastatic bone disease
3) Malignant fibrous histiocytoma
2) Multiple myeloma
5) Dedifferentiated chondrosarcoma
4) Lymphoma

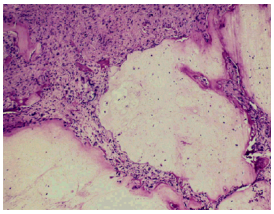
The plain radiographs show two major features. The proximal portion of the lesion (top half) shows an intramedullary lesion, which is mineralized. The mineralization shows rings and stipples. There is also thickening of the cortex of the femur. This thickening is circumferential on the medial, lateral, anterior, and posterior cortices. These features strongly suggest a cartilage tumor, principally a chondrosarcoma. The distal (lower half) of the lesion has a different pattern. The intramedullary lesion is completely lytic, and the lateral cortex has been destroyed. This bimorphic pattern is seen with dedifferentiated chondrosarcoma. The bimorphic pattern is a low-grade chondrosarcoma and a high-grade anaplastic spindle cell sarcoma.

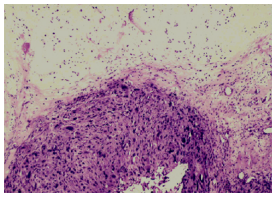
The histologic appearance is also bimorphic. Notice the cartilage, which is relatively hypocellular, and the intimate admixture of a high-grade spindle cell sarcoma. The high-grade spindle sarcoma is characterized by pleomorphic and pyknotic nucleiâdark staining nuclear chromatin, and different sizes and shapes of the nuclei. The bimorphic pattern is low-grade cartilage admixed with high-grade spindle cell sarcoma. This high-grade spindle cell sarcoma can be osteosarcoma, malignant fibrous histiocytoma, or fibrosarcoma.

This tumor is a high-grade malignancy with a long-term survival of only 20% to 40%. The lungs are the most common site of metastases. Treatment is wide resection.

Correct Answer: Dedifferentiated chondrosarcoma

3626. (1134) Q9-1497:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man has a 6-month history of increasing knee pain. He has discomfort at night and at rest. His anteroposterior and lateral radiographs are shown in Slide 1, and low and high power biopsy specimens are shown in Slides 2 and 3. The treatment of this lesion would be:

1) Intramedullary rod fixation and external beam irradiation
3) Wide resection and custom prosthetic replacement
2) Curettage, cement augmentation and plate fixation
5) Neck exploration and parathyroidectomy
4) External beam irradiation alone

The plain radiographs show two major features. The proximal portion of the lesion (top half) shows an intramedullary lesion, which is mineralized. The mineralization shows rings and stipples. There is also thickening of the cortex of the femur. This thickening is circumferential on the medial, lateral, anterior, and posterior cortices. These features strongly suggest a cartilage tumor, principally a chondrosarcoma. The distal (lower half) of the lesion has a different pattern. The intramedullary lesion is completely lytic, and the lateral cortex has been destroyed. This bimorphic pattern is seen with dedifferentiated chondrosarcoma. The bimorphic pattern is a low-grade chondrosarcoma and a high-grade anaplastic spindle cell sarcoma.

The histologic appearance is also bimorphic. Notice the cartilage, which is relatively hypocellular, and the intimate admixture of a high-grade spindle cell sarcoma. The high-grade spindle sarcoma is characterized by pleomorphic and pyknotic nucleiâdark staining nuclear chromatin, and different sizes and shapes of the nuclei. The bimorphic pattern is low-grade cartilage admixed with high-grade spindle cell sarcoma. This high-grade spindle cell sarcoma can be osteosarcoma, malignant fibrous histiocytoma, or fibrosarcoma.

The treatment of dedifferentiated chondrosarcoma is wide resection and custom replacement. Amputation with a wide margin would be another option.

The prognosis is poor with a long-term survival of only 20% to 40%. The most common site of metastases is to the lungs.

Correct Answer: Wide resection and custom prosthetic replacement

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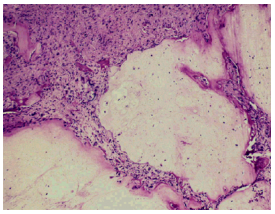
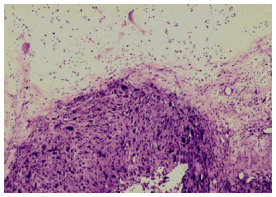
3627. (1135) Q9-1498:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man has a 6-month history of increasing knee pain. He has discomfort at night and at rest. His anteroposterior and lateral radiographs are shown in Slide 1, and low and high power biopsy specimens are shown in Slides 2 and 3. The prognosis for this patient would be:

1) Excellent (> 90% long-term survival)
3) Poor (< 25% long-term survival)
2) Good (> 50% long-term survival)
5) Dismal (no long-term survivors but prolonged disease course)
4) Dismal (no long-term survivors)

The plain radiographs show two major features. The proximal portion of the lesion (top half) shows an intramedullary lesion, which is mineralized. The mineralization shows rings and stipples. There is also thickening of the cortex of the femur. This thickening is circumferential on the medial, lateral, anterior, and posterior cortices. These features strongly suggest a cartilage tumor, principally a chondrosarcoma. The distal (lower half) of the lesion has a different pattern. The intramedullary lesion is completely lytic, and the lateral cortex has been destroyed. This bimorphic pattern is seen with dedifferentiated chondrosarcoma. The bimorphic pattern is a low-grade chondrosarcoma and a high-grade anaplastic spindle cell sarcoma.

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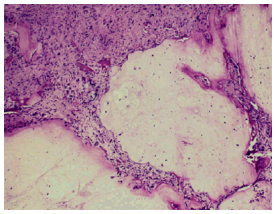
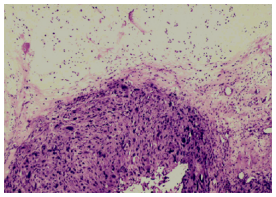
Dedifferentiated chondrosarcomas are very high-grade lesions with a poor prognosis. Long-term survival is < 25% of patients.

Correct Answer: Poor (< 25% long-term survival)

3628. (1136) Q9-1499:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man has a 6-month history of increasing knee pain. He has discomfort at night and at rest. His anteroposterior and lateral radiographs are shown in Slide 1 and low and high power biopsy specimens in Slides 2 and 3. Chest radiograph and computerized tomography scans are normal. The stage of disease according to the system of the Musculoskeletal Tumor Society is:

1) Stage 1
3) Stage I
2) Stage 2
5) Stage III
4) Stage II

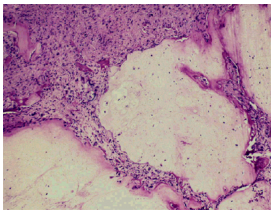
The plain radiographs show two major features. The proximal portion of the lesion (top half) shows an intramedullary lesion, which is mineralized. The mineralization shows rings and stipples. There is also thickening of the cortex of the femur. This thickening is circumferential on the medial, lateral, anterior, and posterior cortices. These features strongly suggest a cartilage tumor, principally a chondrosarcoma. The distal (lower half) of the lesion has a different pattern. The intramedullary lesion is completely lytic, and the lateral cortex has been destroyed. This bimorphic pattern is seen with dedifferentiated chondrosarcoma. The bimorphic pattern is a low-grade chondrosarcoma and a high-grade anaplastic spindle cell sarcoma.

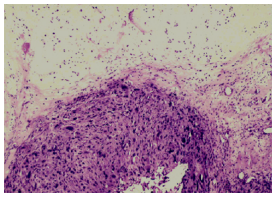
The histologic appearance is also bimorphic. Notice the cartilage, which is relatively hypocellular, and the intimate admixture of a high-grade spindle cell sarcoma. The high-grade spindle sarcoma is characterized by pleomorphic and pyknotic nucleiâdark staining nuclear chromatin, and different sizes and shapes of the nuclei. The bimorphic pattern is low-grade cartilage admixed with high-grade spindle cell sarcoma. This high-grade spindle cell sarcoma can be osteosarcoma, malignant fibrous histiocytoma, or fibrosarcoma.

This patient has a high-grade sarcoma and the staging studies show no evidence of pulmonary metastases. The surgical stage would be stage II. If an magnetic resonance imaging scan showed soft tissue extension, then the stage would be Stage IIB.

Correct Answer: Stage II

3629. (1137) Q9-1500:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man has a 6-month history of increasing knee pain. He has discomfort at night and at rest. His anteroposterior and lateral radiographs are shown in Slide 1 and low and high power biopsy specimens in Slides 2 and 3. The most common site of metastases in this patient would be:

1) Other bones
3) Liver
2) Lymph nodes
5) Brain
4) Lung

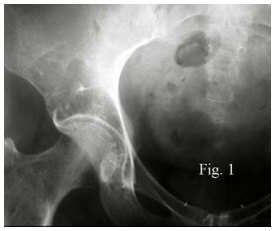
The plain radiographs show two major features. The proximal portion of the lesion (top half) shows an intramedullary lesion, which is mineralized. The mineralization shows rings and stipples. There is also thickening of the cortex of the femur. This thickening is circumferential on the medial, lateral, anterior, and posterior cortices. These features strongly suggest a cartilage tumor, principally a chondrosarcoma. The distal (lower half) of the lesion has a different pattern. The intramedullary lesion is completely lytic, and the lateral cortex has been destroyed. This bimorphic pattern is seen with dedifferentiated chondrosarcoma. The bimorphic pattern is a low-grade chondrosarcoma and a high-grade anaplastic spindle cell sarcoma.

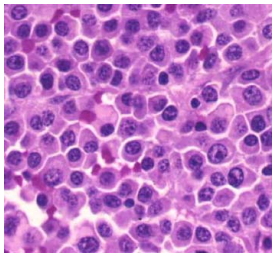
The histologic appearance is also bimorphic. Notice the cartilage, which is relatively hypocellular, and the intimate admixture of a high-grade spindle cell sarcoma. The high-grade spindle sarcoma is characterized by pleomorphic and pyknotic nucleiâdark staining nuclear chromatin, and different sizes and shapes of the nuclei. The bimorphic pattern is low-grade cartilage admixed with high-grade spindle cell sarcoma. This high-grade spindle cell sarcoma can be osteosarcoma, malignant fibrous histiocytoma, or fibrosarcoma.

Dedifferentiated chondrosarcomas are very lethal malignancies with only a 25% long-term survival rate. They most commonly metastasize to the lungs.

Correct Answer: Lung

3630. (1138) Q9-1502:





Slide 1 **Slide 2**

A 66-year-old man has a 4-month history of hip discomfort. The plain radiographs are shown in Slide 1 and a biopsy is shown in Slide 2. The most appropriate treatment would be:

1) Wide resection of the acetabulum
3) Systemic chemotherapy
2) Curettage and bone grafting
5) Subacromial cortisone injection
4) Forequarter amputation

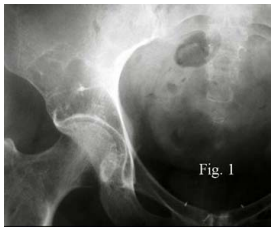
A destructive lesion in the pelvis may be secondary to five common processes in patients who are 40 to 80 years of age, including metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma. Often a biopsy is necessary to establish the diagnosis. The biopsy specimen shows plasma cells. The plasma cells have these characteristics:

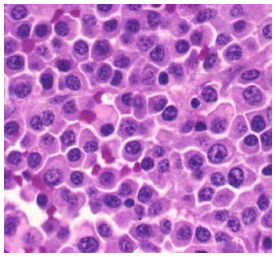
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

The diagnosis is multiple myeloma. The treatment of multiple myeloma is systemic chemotherapy (usually prednisone and an alkylating agent). External beam radiation is used for pain control and to stop lesion progression. When there is no risk of impending fracture, chemotherapy would be tried first.

Correct Answer: Systemic chemotherapy

3631. (1139) Q9-1503:





Slide 1 **Slide 2**

A 66-year-old man has a 4-month history of hip discomfort. The plain radiographs are shown in Slide 1 and a biopsy is shown in Slide 2. Which of the following tests would be recommended to assess the extent of this condition:

1) Computerized tomography scan and technetium bone scan
3) Skeletal survey and bone marrow aspiration
2) Technetium bone scan alone
5) Positron emission tomography scan of the brain and computerized tomography of the chest
4) Computerized tomography of the chest and abdomen and technetium bone scan

A destructive lesion in the pelvis may be secondary to five common processes in patients who are 40 to 80 years of age, including metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma. Often a biopsy is necessary to establish the diagnosis. The biopsy specimen shows plasma cells. The plasma cells have these characteristics:

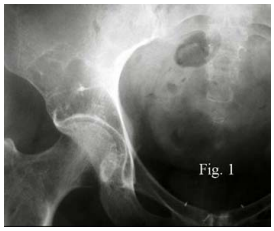
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

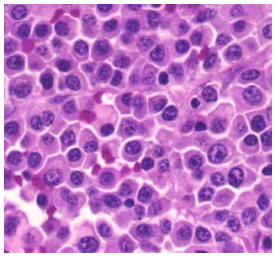
The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, and chemistry studies including kidney function and serum calcium determination.

Technetium bone scans have a high false-negative rate and are not used in the staging process. Neither computerized tomography scans nor brain scans are routinely used.

Correct Answer: Skeletal survey and bone marrow aspiration

3632. (1140) Q9-1504:





Slide 1 **Slide 2**

A 66-year-old man has a 4-month history of hip discomfort. The plain radiographs are shown in Slide 1 and a biopsy is shown in Slide 2. Which of the following tests would not be recommended to assess the extent of this condition (staging studies):

1) Bone marrow biopsy
3) Serum creatinine and blood urea nitrogen
2) Serum calcium level
5) Skeletal survey
4) Technetium bone scan

A destructive lesion in the pelvis may be secondary to five common processes in patients who are 40 to 80 years of age, including metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma. Often a biopsy is necessary to establish the diagnosis. The biopsy specimen shows plasma cells. The plasma cells have these characteristics:

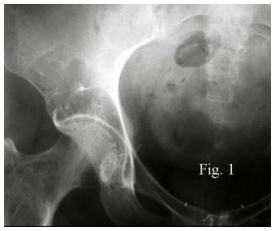
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

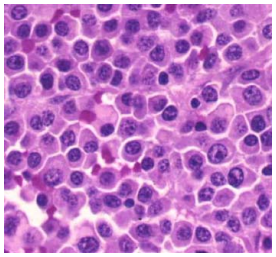
The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, and chemistry studies, including kidney function and serum calcium determination.

Technetium bone scans have a high false-negative rate and are not used in the staging process. Neither computerized tomography scans nor brain scans are routinely used.

Correct Answer: Technetium bone scan

3633. (1141) Q9-1505:





Slide 1 **Slide 2**

A 66-year-old man has a 4-month history of hip discomfort. The plain radiographs are shown in Slide 1 and a biopsy is shown in Slide 2. Which of the following tests would be ordered to further confirm the diagnosis:

1) Serum protein electrophoresis
3) Urine hydroxy proline levels
2) Serum alkaline phosphatase level
5) Serum prostate-specific antigen level
4) Serum parathyroid hormone level

A destructive lesion in the pelvis may be secondary to five common processes in patients who are 40 to 80 years of age, including metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma. Often a biopsy is necessary to establish the diagnosis. The biopsy specimen shows plasma cells. The plasma cells have these characteristics:

- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

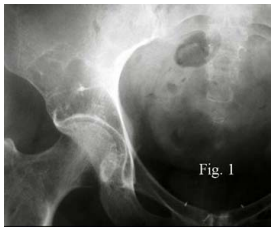
The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, hemoglobin level, and chemistry studies including kidney function and serum calcium determination. Serum protein electrophoresis is sensitive in 75% of patients, whereas urine immunoelectrophoresis is 95% sensitive.

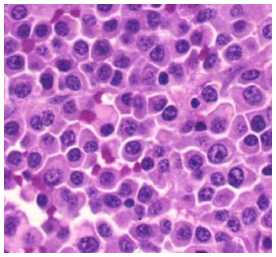
Serum protein electrophoresis is performed to assess the amount of abnormal gammaglobulin in the serum. There are three major criteria in the diagnosis of multiple myeloma:

- Plasmacytoma on tissue biopsy
- Bone marrow plasmacytosis > 30% plasma cells
- Monoclonal immunoglobulin spike on serum protein electrophoresis exceeding 3.5 g/dl for G peaks or 2.0 g/dl for A peaks or 1.0 g/24 hours of kappa or lamba light chain excretion on urine electrophoresis

Correct Answer: Serum protein electrophoresis

3634. (1142) Q9-1506:





Slide 1 **Slide 2**

A 66-year-old man has a 4-month history of hip discomfort. The plain radiographs are shown in Slide 1 and a biopsy is shown in Slide 2. Which of the following tests will probably be abnormal:

1) Serum alkaline phosphatase levels
3) Serum parathyroid hormone level
2) Urine hydroxyproline levels
5) Serum prostate specific antigen level
4) Serum hemoglobin and erythrocyte sedimentation rate

A destructive lesion in the pelvis may be secondary to five common processes in patients who are 40 to 80 years of age, including metastatic bone disease, multiple myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma. Open biopsy is often necessary to establish the diagnosis. The biopsy specimen shows plasma cells. The plasma cells have these characteristics:

- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, hemoglobin level, and chemistry studies including kidney function and serum calcium determination.

The serum hemoglobin and erythrocyte sedimentation rate will be abnormal in approximately two-thirds of patients.

(Hemoglobin <12g/d/ l and ESR 750mm/h)Correct Answer: Serum hemoglobin and erythrocyte sedimentation rate

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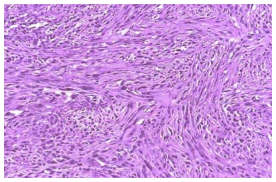
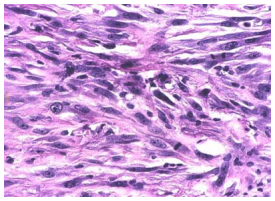
3635. (1143) Q9-1507:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

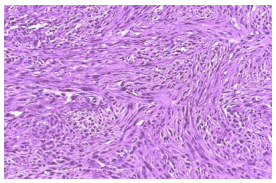
A 55-year-old man has a 4-month history of increasing knee pain. The plain radiographs are shown in Slide 1, and a coronal T1 weighted magnetic resonance scan is shown in Slide 2. A biopsy of the lesion is shown in Slides 3 and 4. The most likely diagnosis is:

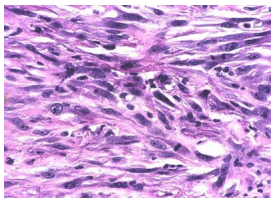
1) Metastatic bone disease
3) Chondrosarcoma
2) Multiple myeloma
5) Malignant fibrous histiocytoma
4) Lymphoma

The plain radiograph shows a destructive lesion in the distal femoral metaphysis. Notice the lesion is purely lytic. The magnetic resonance imaging scan shows a very large lesion with destruction of the cortex and a large soft tissue mass. This radiograph appearance indicates a malignant lesion. The possibilities include a chondrosarcoma, malignant fibrous histiocytoma, metastasis, myeloma, and lymphoma. The biopsy specimen shows a storiform pattern with fascicles of spindle cells. The high power specimen shows spindle cells with pleomorphism, which are different nuclear sizes and shapes, and histiocytes, which are cells with round and vesicular nuclei. The diagnosis is malignant fibrous histiocytoma.

Correct Answer: Malignant fibrous histiocytoma

3636. (1144) Q9-1508:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

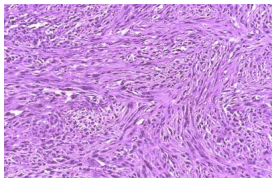
A 55-year-old man has a 4-month history of increasing knee pain. The plain radiographs are shown in Slide 1 and a coronal T1 weighted magnetic resonance scan is shown in Slide 2. A biopsy of the lesion is shown in Slides 3 and 4. The most appropriate treatment method would be:

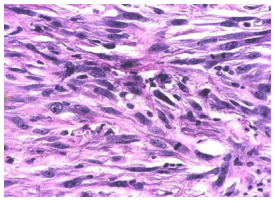
1) Curettage and cement augmentation
3) External beam irradiation alone
2) Curettage, cement augmentation, and external beam irradiation
5) Wide resection
4) External beam irradiation, diphosphonates, and chemotherapy

The plain radiograph shows a destructive lesion in the distal femoral metaphysis. Notice the lesion is purely lytic. The magnetic resonance imaging scan shows a very large lesion with destruction of the cortex and a large soft tissue mass. This radiographic appearance indicates a malignant lesion. The possibilities include a chondrosarcoma, malignant fibrous histiocytoma, metastasis, myeloma, and lymphoma. The biopsy specimen shows a storiform pattern with fascicles of spindle cells. The high power specimen shows spindle cells with pleomorphism, which are different nuclear sizes and shapes, and histiocytes, which are cells with round and vesicular nuclei. The diagnosis is malignant fibrous histiocytoma. The treatment of malignant fibrous histiocytoma is wide resection. Wide resection can be accomplished with limb salvage or amputation.

Correct Answer: Wide resection

3637. (1145) Q9-1509:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

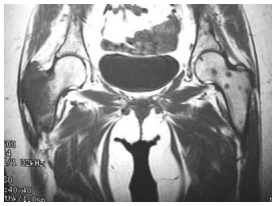
A 55-year-old man has a 4-month history of increasing knee pain. The plain radiographs are shown in Slide 1 and a coronal T1 weighted magnetic resonance scan is shown in Slide 2. A biopsy of the lesion is shown in Slides 3 and 4. Which of the following studies should be done to aid in staging of the patientâs disease:

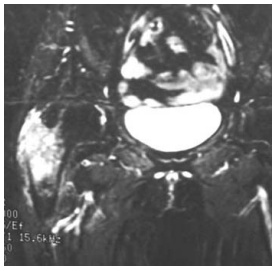
1) Skeletal survey
3) Bone marrow aspiration/biopsy
2) Serum protein electrophoresis
5) CT scan of the abdomen
4) Computed tomography (CT) scan of the chest

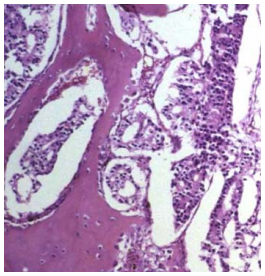
The plain radiograph shows a destructive lesion in the distal femoral metaphysis. Notice the lesion is purely lytic. The magnetic resonance imaging scan shows a very large lesion with destruction of the cortex and a large soft tissue mass. This radiograph appearance indicates a malignant lesion. The possibilities include a chondrosarcoma, malignant fibrous histiocytoma, metastasis, and lymphoma. The biopsy specimen shows a storiform pattern and fascicle of spindle cells. The high power specimen shows spindle cells with pleomorphism, which are different nuclear sizes and shapes, and histiocytes, which are cells with round and vesicular nuclei. The diagnosis is malignant fibrous histiocytoma. The most common site of metastases would be to the lungs. The best staging test would be a CT scan of the chest. Skeletal survey, serum protein electrophoresis, and bone marrow aspiration would be used for staging in multiple myeloma. Computed tomography of the chest and abdomen is used for staging in metastatic bone disease.

Correct Answer: Computed tomography (CT) scan of the chest

3638. (1146) Q9-1510:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

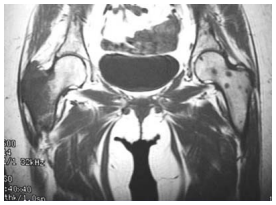
A 65-year-old woman has a 5-month history of increasing hip and thigh pain. Her plain radiographs are shown in Slide 1. T1 and T2 weighted coronal images of her hip are shown in Slides 2 and 3 respectively. A biopsy is performed and is shown in Slide 4. The most likely diagnosis is:

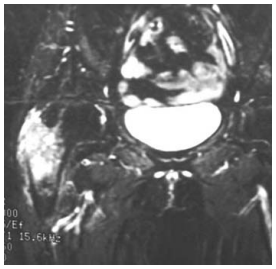
1) Multiple myeloma
3) Metastatic adenocarcinoma
2) Lymphoma
5) Paget disease
4) Chondrosarcoma

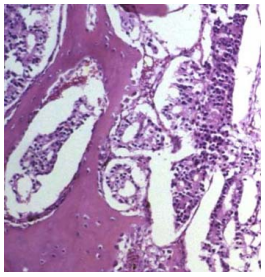
The plain radiographs show an ill-defined permeative lesion in the proximal femur. The lateral cortex of the greater trochanter is thinned. The T1 weighted coronal images show a low signal lesion in the entire greater trochanter extending to the base of the femoral neck. Notice in the opposite proximal femur and acetabulum, there are multiple small low signal lesions consistent with metastatic bone disease. The T2 weighted images show a very high signal area in the greater trochanter. The inversion recovery image is very sensitive to pathologic processes. Normal marrow will be very low signal while pathologic lesions are high signal. The biopsy shows round epithelial cells forming glands. This pattern is that of metastatic adenocarcinoma.

Correct Answer: Metastatic adenocarcinoma

3639. (1147) Q9-1511:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has a 5-month history of increasing hip and thigh pain. Her plain radiographs are shown in Slide 1. She has severe pain with weight bearing on the right leg. T1 and T2 weighted coronal images of her hip are shown in Slides 2 and 3 respectively. A biopsy is performed and is shown in Slide 4. The most appropriate treatment would be:

1) Hip disarticulation
3) Wide resection and custom proximal femoral replacement
2) Neck exploration and removal of her parathyroid glands
5) Internal fixation followed by external beam irradiation
4) Crutch ambulation for 6 to 8 weeks

The plain radiographs show an ill-defined permeative lesion in the proximal femur. The lateral cortex of the greater trochanter is thinned. The T1 weighted coronal images show a low signal lesion in the entire greater trochanter extending to the base of the femoral neck. Notice in the opposite proximal femur and acetabulum, there are multiple small low signal lesions consistent with metastatic bone disease. The T2 weighted images show a very high signal area in the greater trochanter. The inversion recovery image is very sensitive to pathologic processes. Normal marrow will be very low signal while pathologic lesions are high signal. The biopsy shows round epithelial cells forming glands. This pattern is that of metastatic adenocarcinoma.

The treatment of metastatic breast carcinoma of bone is external beam irradiation to symptomatic lesions and diphosphonate therapy to retard the bone loss. Internal fixation is performed to prevent pathologic fracture. When patients have significant weight bearing pain, and a purely lytic lesion in the hip, the risk of fracture is high. The best treatment method for this patient is internal fixation followed by external beam irradiation.

Correct Answer: Internal fixation followed by external beam irradiation

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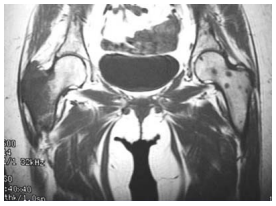
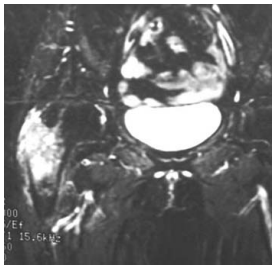
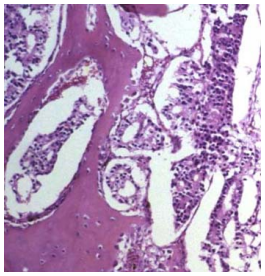
3640. (1148) Q9-1512:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has a 5-month history of increasing hip and thigh pain. Her plain radiographs are shown in Slide 1. She has severe pain with weight bearing on the right leg. T1 and T2 weighted coronal images of her hip are shown in Slides 2 and 3 respectively. A biopsy is performed and is shown in Slide 4. The cells directly responsible for the bone destruction would be:

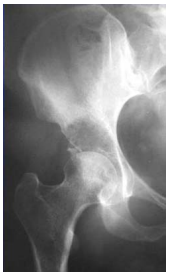
1) Tumor cells
3) Osteoclasts
2) Fibroblasts
5) Plasma cells
4) Histiocytes

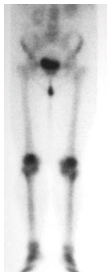
The plain radiographs show an ill-defined permeative lesion in the proximal femur. The lateral cortex of the greater trochanter is thinned. The T1 weighted coronal images show a low signal lesion in the entire greater trochanter extending to the base of the femoral neck. Notice in the opposite proximal femur and acetabulum, there are multiple small low signal lesions consistent with metastatic bone disease. The T2 weighted images show a very high signal area in the greater trochanter. The inversion recovery image is very sensitive to pathologic processes. Normal marrow will be very low signal while pathologic lesions are high signal. The biopsy shows round epithelial cells forming glands. This pattern is that of metastatic adenocarcinoma.

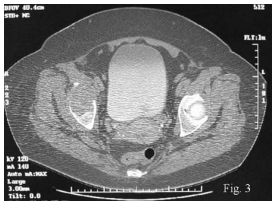
The bone destruction in metastatic bone disease is a direct result of osteoclastic resorption of the bone. The metastatic breast cells secrete a factor that activates and recruits osteoclasts, which then destroy the bone. Diphosphonate therapy (usually intravenous pamidronate) is given to virtually all women with metastatic breast carcinoma to bone to stop the osteoclasts from resorbing the bone matrix.

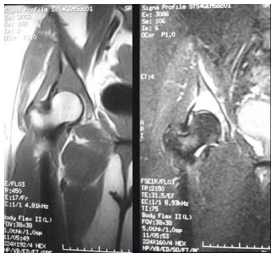
Correct Answer: Osteoclasts

3641. (1149) Q9-1513:

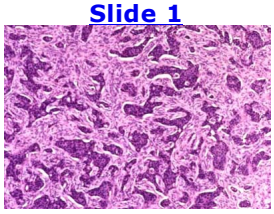




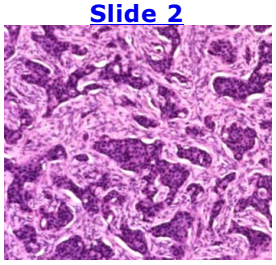




[Slide 1](#)



[Slide 2](#)



[Slide 3](#)

[Slide 4](#)

[Slide 5](#)

[Slide 6](#)

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs are shown in Slide 1. The technetium bone scan, computerized tomography scan, and coronal T1 and T2 weighted magnetic resonance imaging scans are shown in Slides 2, 3, and 4 respectively. A needle biopsy is performed and shown in Slides 5 and 6. The most likely diagnosis is:

1) Metastatic adenocarcinoma
3) Lymphoma
2) Multiple myeloma
5) Malignant fibrous histiocytoma
4) Chondrosarcoma

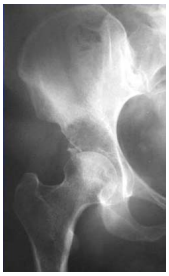
The plain radiographs show a purely lytic destructive lesion, which is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is very suggestive of a malignancy. The magnetic resonance imaging scan shows a lesion that is homogenously low on T1 weighted images and high on T2 weighted images. One cannot make a definitive diagnosis based upon the radiographic features. The most common malignancies in this age group are:

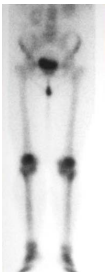
- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Chondrosarcoma
- Malignant fibrous histiocytoma

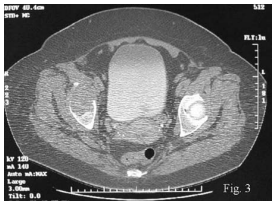
The biopsy specimen shows round epithelial appearing cells that are grouped in clusters. The cells are arranged in a fibrous background. The diagnosis is metastatic bone disease.

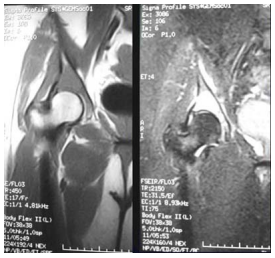
Correct Answer: Metastatic adenocarcinoma

3642. (1150) Q9-1514:

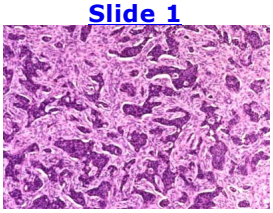




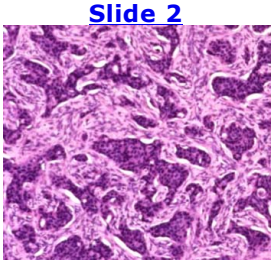




Slide 1



Slide 2



Slide 3

Slide 4

Slide 5

Slide 6

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs are shown in Slide 1. The technetium bone scan, computerized tomography scan, and coronal T1 and T2 weighted magnetic resonance imaging scans are shown in Slides 2, 3, and 4 respectively. A needle biopsy is performed and shown in Slides 5 and 6. Which of the following would be the most appropriate treatment regimen:

1) Wide resection and allograft acetabular reconstruction
3) Preoperative chemotherapy followed by wide resection
2) Internal hemi-pelvectomy alone
5) Hemi-pelvectomy
4) Acetabular reconstruction followed by external beam irradiation

The plain radiographs show a purely lytic destructive lesion, which is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is very suggestive of a malignancy. The magnetic resonance imaging scan shows a lesion that is homogenously low on T1 weighted images and high on T2 weighted images. One cannot make a definitive diagnosis based upon the radiographic features. The most common malignancies in this age group are:

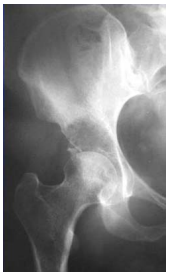
- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Chondrosarcoma
- Malignant fibrous histiocytoma

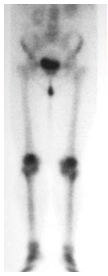
The biopsy specimen shows round epithelial-appearing cells that are grouped in clusters. The cells are arranged in a fibrous background. The diagnosis is metastatic bone disease.

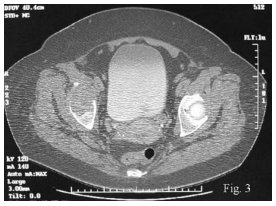
The treatment of metatastic bone disease is either internal fixation with postoperative external beam irradiation or external beam irradiation alone. In this case, there is very extensive destruction and fracture is imminent. The treatment of choice would be acetabular reconstruction followed by external beam irradiation.

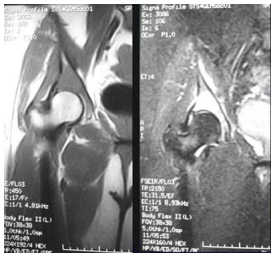
Correct Answer: Acetabular reconstruction followed by external beam irradiation

3643. (1151) Q9-1515:









Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs are shown in Slide 1. The technetium bone scan, computerized tomography scan, and coronal T1 and T2 weighted magnetic resonance imaging scans are shown in Slides 2, 3, and 4 respectively. The most likely diagnosis based upon the radiographs would be:

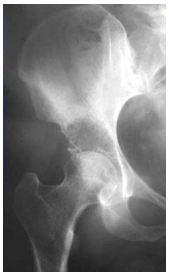
1) Septic arthritis
3) Stress fracture
2) Osteomyelitis of the acetabulum
5) Malignant neoplasm
4) Lytic phase of Paget disease

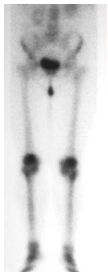
The plain radiographs show a purely lytic destructive lesion, which is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is very suggestive of a malignancy. The magnetic resonance imaging scan shows a lesion that is homogenously low on T1 weighted images and high on T2 weighted images. One cannot make a definitive diagnosis based upon the radiographic features; however, it is highly likely that this lesion is malignant. The cortical bone destruction is highly suggestive of a malignancy. The most common malignancies in this age group are:

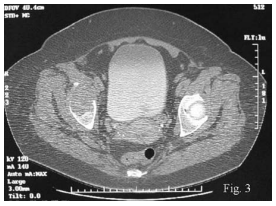
- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Chondrosarcoma
- Malignant fibrous histiocytoma

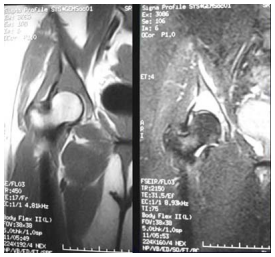
Correct Answer: Malignant neoplasm

3644. (1152) Q9-1516:

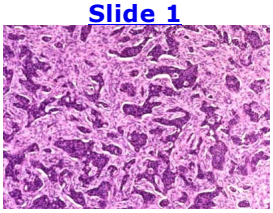


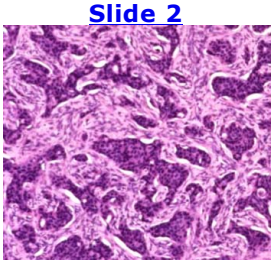






Slide 1 **Slide 2** **Slide 3** **Slide 4**





Slide 5 **Slide 6**

A 50-year-old woman has had severe hip pain for 4 months. Her plain radiographs are shown in Slide 1. The technetium bone scan, computerized tomography scan, and coronal T1 and T2 weighted magnetic resonance imaging scans are shown in Slides 2, 3, and 4 respectively. A needle biopsy is performed and shown in Slides 5 and 6. The cells directly responsible for the bone destruction would be:

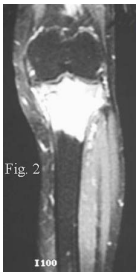
1) Tumor cells
3) Fibroblasts
2) Plasma cells
5) Mast cells
4) Osteoclasts

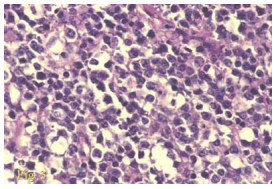
The plain radiographs show a purely lytic destructive lesion, which is poorly marginated. The technetium bone scan does not show any major uptake. The computerized tomography scan shows purely lytic bone destruction with breakthrough of the cortical bone. Complete destruction of the cortical bone is very suggestive of a malignancy. The magnetic resonance imaging scan shows a lesion that is homogenously low on T1 weighted images and high on T2 weighted images. One cannot make a definitive diagnosis based upon the radiographic features, however it is highly likely that this lesion is malignant. The biopsy specimen shows round epithelial-appearing cells that are grouped in clusters. The cells are arranged in a fibrous background. The diagnosis is metastatic bone disease.

The bone destruction in metastatic bone disease is a direct result of osteoclastic resorption of the bone. The metastatic breast cells secrete a factor that activates and recruits osteoclasts which then destroy the bone. Diphosphonate therapy (usually intravenous pamidronate) is given to virtually all women with metastatic breast carcinoma to bone to stop the osteoclasts from resorbing the bone matrix.

Correct Answer: Osteoclasts

3645. (1153) Q9-1517:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old woman has severe knee pain that has been increasing for 6 months. The anteroposterior radiograph and T2 weighted coronal magnetic resonance imaging scan are shown in Slides 1 and 2. The biopsy specimen is shown in Slide 3. The most likely diagnosis is:

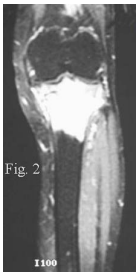
1) Metastatic bone disease
3) Lymphoma
2) Multiple myeloma
5) Malignant fibrous histiocytoma
4) Chondrosarcoma

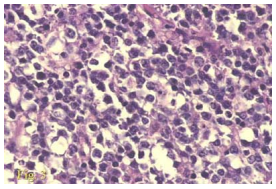
The anteroposterior radiograph shows both arthritic changes in the medial compartment and a lytic destructive lesion in the lateral tibial plateau. Note the lucent area laterally and the area of increased density medially. The T2 weighted coronal magnetic resonance imaging scan shows complete marrow replacement of the proximal tibial plateau. The normal marrow is dark (low signal) and the tumor is high signal (white). The biopsy shows a mixture of large and small blue cells. This is the histologic appearance of lymphoma. Note that the other choices have characteristic histologic appearances.

- Metastatic bone disease - epithelial cells organized in clusters in a fibrous background
- Multiple myeloma - sheets of plasma cells, that have an eccentric nucleus with peripheral chromatin. There is also peri nuclear clearing or a halo where the Golgi apparatus is located
- Chondrosarcoma - atypical chondrocytes in a blue chondroid matrix
- Malignant fibrous histiocytoma - fascicles of fibroblasts and histiocytes in a storiform pattern

Correct Answer: Lymphoma

3646. (1154) Q9-1518:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old woman has severe knee pain that has been increasing for 6 months. The anteroposterior radiograph and T2 weighted coronal magnetic resonance imaging scan are shown in Slides 1 and 2. The biopsy specimen is shown in Slide 3. The most appropriate treatment method would be:

1) Wide resection and custom arthroplasty
3) Curettage and cement augmentation
2) Above knee amputation
5) Curettage and bone grafting
4) External beam irradiation and chemotherapy

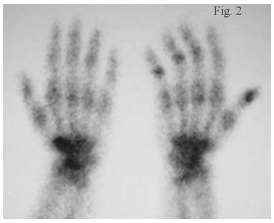
The anteroposterior radiograph shows both arthritic changes in the medial compartment and a lytic destructive lesion in the lateral tibial plateau. Note the lucent area laterally and the area of increased density medially. The increased bone density gives a mottled appearance to the bone. The T2 weighted coronal magnetic resonance imaging scan shows complete marrow replacement of the proximal tibial plateau. The normal marrow is dark (low signal) and the tumor is high signal (white). The biopsy shows a mixture of large and small blue cells. This is the histologic appearance of lymphoma. One should remember the characteristic histologic appearances of bone tumors in adults.

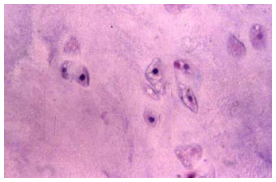
- Metastatic bone disease - epithelial cells organized in clusters in a fibrous background
- Multiple myeloma - sheets of plasma cells, that have an eccentric nucleus with peripheral chromatin. There is also peri nuclear clearing or a halo where the Golgi apparatus is located
- Chondrosarcoma - atypical chondrocytes in a blue chondroid matrix
- Malignant fibrous histiocytoma - fascicles of fibroblasts and histiocytes in a storiform pattern

Most lymphomas of bone are large cell lymphomas and are treated with both external beam irradiation and chemotherapy. Surgical resection is usually not performed.

Correct Answer: External beam irradiation and chemotherapy

3647. (1155) Q9-1519:





Slide 1 **Slide 2** **Slide 3**

A 45-year-old woman sustained minor trauma to her hand while closing a window. Her plain radiograph and technetium bone scan (Slides 1 and 2) are presented. A biopsy is also performed (Slide 3). The most likely diagnosis is:

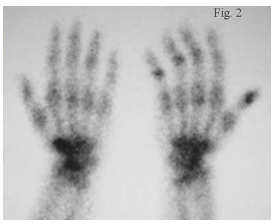
1) Grade 1 chondrosarcoma
3) Giant cell tumor
2) Enchondroma
5) Metastatic breast carcinoma
4) Giant cell reparative granuloma

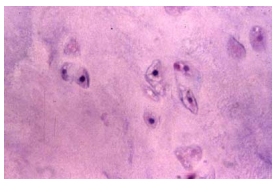
The radiographs show a lucent lesion. The cortices are also thinned. These findings are diagnostic of an enchondroma of the small tubular bones of the hands. In a long bone, this degree of cortical change is diagnostic of a low-grade chondrosarcoma. In the small tubular bones of the hands and feet, these findings are consistent with an enchondroma. The bone scan shows increased uptake. The increased uptake has only limited significance in intramedullary cartilage lesions. Enchondromas may show little, moderate, or heavy uptake. The biopsy specimen shows chondroblasts with blue matrix of cartilage.

When asymptomatic, these lesions are treated with observation, while symptomatic lesions are treated with curettage and grafting.

Correct Answer: Enchondroma

3648. (1156) Q9-1520:





Slide 1 **Slide 2** **Slide 3**

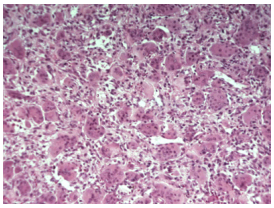
A 45-year-old woman sustained minor trauma to her hand while closing a window. Her plain radiograph and technetium bone scan (Slides 1 and 2) are presented. A biopsy is also performed (Slide 3). The most appropriate treatment would be:

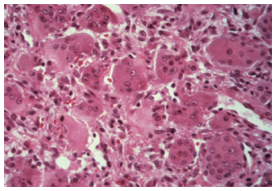
1) External beam irradiation
3) Amputation through the mid aspect of the proximal phalanx
2) External beam irradiation and systemic chemotherapy
5) Curettage and bone grafting
4) Thumb ray amputation

The radiographs show a lucent lesion. The cortices are also thinned. These findings are diagnostic of an enchondroma of the small tubular bones of the hands. The treatment of enchondromas is curettage and bone grafting. If the enchondroma is asymptomatic, observation would also be an acceptable treatment method.

Correct Answer: Curettage and bone grafting

3649. (1274) Q9-1644:





Slide 1 **Slide 2** **Slide 3**

A 28-year-old woman has a 4-month history of increasing shoulder pain. Her plain radiograph is shown in Slide 1. A biopsy specimen is shown in Slides 2 and 3. The most likely diagnosis is:

1) Aneurysmal bone cyst
3) Telangiectatic osteosarcoma
2) Chondroblastoma
5) Unicameral bone cyst
4) Giant cell tumor

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

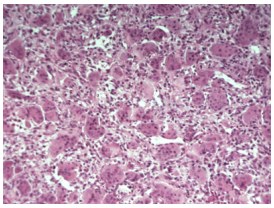
- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

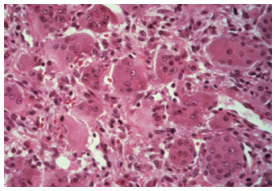
Unicameral bone cysts are rare in skeletally mature patients and the cortices are thinned but intact. Chondroblastomas are usually not this destructive.

The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

Correct Answer: Giant cell tumor

3650. (1275) Q9-1645:





Slide 1 **Slide 2** **Slide 3**

A 28-year-old woman has a 4-month history of increasing shoulder pain. Her plain radiograph is shown in Slide 1. A biopsy specimen is shown in Slides 2 and 3. Which of the following is the best treatment option:

1) Preoperative chemotherapy followed by resection/reconstruction
3) Resection/reconstruction followed by chemotherapy
2) Resection/reconstruction followed by external beam irradiation
5) Amputation
4) Resection/reconstruction

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

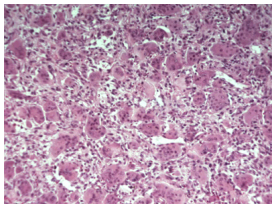
- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

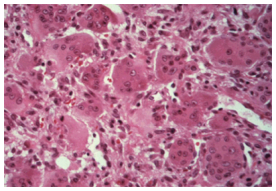
The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

Treatment of this lesion is resection followed by reconstruction. The reconstructive options include an osteoarticular allograft, allograft prosthetic composite, or a custom prosthesis. There is too much bone destruction to perform a curettage procedure.

Correct Answer: Resection/reconstruction

3651. (1276) Q9-1646:





Slide 1 **Slide 2** **Slide 3**

A 28-year-old woman has a 4-month history of increasing shoulder pain. Her plain radiograph is shown in Slide 1. A biopsy specimen is shown in Slides 2 and 3. Which of the following is the correct stage according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

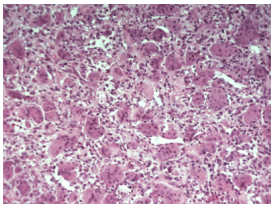
This lesion is an aggressive benign tumor â Stage 3.

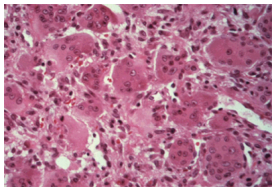
Remember the Musculoskeletal Tumor Society staging system:

Stage 1	Benign inactive
Stage 2	Benign active
Stage 3	Benign aggressive
Â	
Stage I	Low grade malignant
Stage II	High grade malignant
Stage III	Metastases to any site

Correct Answer: Stage 3

3652. (1277) Q9-1647:





Slide 1 **Slide 2** **Slide 3**

A 28-year-old woman has a 4-month history of increasing shoulder pain. Her plain radiograph is shown in Slide 1. A biopsy specimen is shown in Slides 2 and 3. Which of the following is the correct risk of pulmonary metastases for this lesion:

1) 0%
3) 10% to 30%
2) 2% to 5%
5) 75%
4) 30% to 50%

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

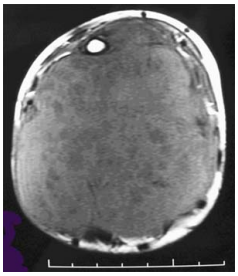
- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

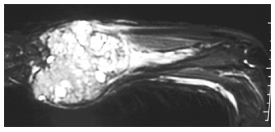
The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

The risk of pulmonary metastases in giant cell tumor of bone is 2% to 5%. This phenomenon is called benign metastasizing giant cell tumor. The mortality rate from these metastases is 10% to 20%. Spontaneous regression of the pulmonary lesions may occur.

Correct Answer: 2% to 5%

3653. (1278) Q9-1648:





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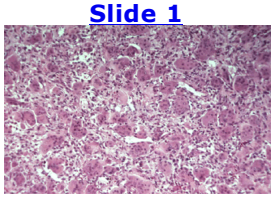


Slide 5

A 15-year-old girl has a 4-month history of increasing wrist pain. Her clinical photograph and plain radiograph are shown in Slides 1 and 2. An axial T1-weighted image and sagittal T2-weighted image are shown in Slides 3 and 4. A biopsy specimen is shown in Slide 5. The most likely diagnosis is:

1) Unicameral bone cyst
3) Chondroblastoma
2) Aneurysmal bone cyst
5) Giant cell tumor
4) Telangiectatic osteosarcoma

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

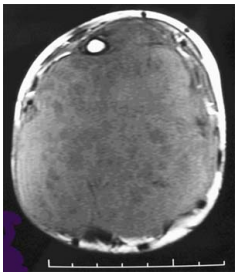
- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

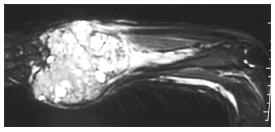
Unicameral bone cysts are rare in skeletally mature patients and the cortices are thinned but intact. Chondroblastomas are usually not this destructive.

The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

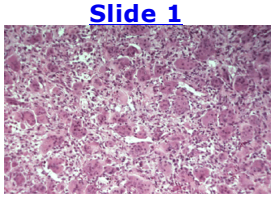
Correct Answer: Giant cell tumor

3654. (1279) Q9-1649:





Slide 1 **Slide 2** **Slide 3** **Slide 4**



Slide 5

A 15-year-old girl has a 4-month history of increasing wrist pain. Her clinical photograph and plain radiograph are shown in Slides 1 and 2. An axial T1-weighted image and sagittal T2-weighted image are shown in Slides 3 and 4. A biopsy specimen is shown in Slide 5. Which of the following is the best treatment option:

1) Preoperative chemotherapy followed by resection/reconstruction
3) Resection/reconstruction followed by chemotherapy
2) Resection/reconstruction followed by external beam irradiation
5) Amputation
4) Resection/reconstruction

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

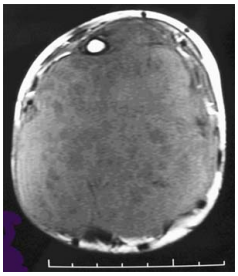
- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

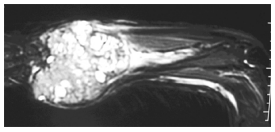
The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

Treatment of this lesion is resection followed by reconstruction. The reconstructive options include an osteoarticular allograft, allograft fusion, or a fibular reconstruction. There is too much bone destruction to perform a curettage procedure.

Correct Answer: Resection/reconstruction

3655. (1280) Q9-1650:





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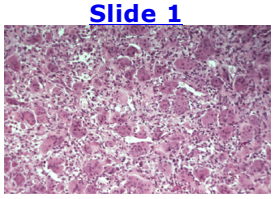


[Slide 5](#)

A 15-year-old girl has a 4-month history of increasing wrist pain. Her clinical photograph and plain radiograph are shown in Slides 1 and 2. An axial T1-weighted image and sagittal T2-weighted image are shown in Slides 3 and 4. A biopsy specimen is shown in Slide 5. Which of the following is the correct stage according to the system of the Musculoskeletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

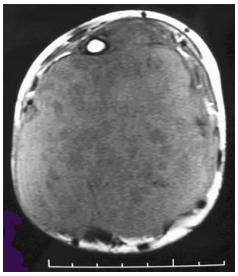
This lesion is an aggressive benign tumor â Stage 3.

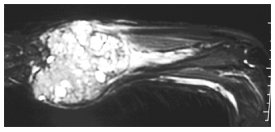
Remember the Musculoskeletal Tumor Society staging system:

Stage 1	Benign inactive
Stage 2	Benign active
Stage 3	Benign aggressive
Â	
Stage I	Low grade malignant
Stage II	High grade malignant
Stage III	Metastases to any site

Correct Answer: Stage 3

3656. (1281) Q9-1651:





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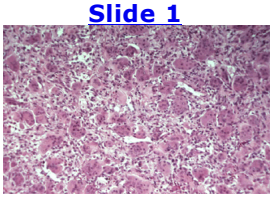


[Slide 5](#)

A 15-year-old girl has a 4-month history of increasing wrist pain. Her clinical photograph and plain radiograph are shown in Slides 1 and 2. An axial T1-weighted image and sagittal T2-weighted image are shown in Slides 3 and 4. A biopsy specimen is shown in Slide 5. Which of the following is the correct risk of pulmonary metastases for this lesion:

1) 0%
3) 10% to 30%
2) 2% to 5%
5) 75%
4) 30% to 50%

The plain radiograph shows a destructive lesion. The lesion is purely lytic, expansile, and there is a pathologic fracture. The lesion has destroyed the metaphysis and extended into the epiphysis.

From a radiographic perspective, this lesion could be:

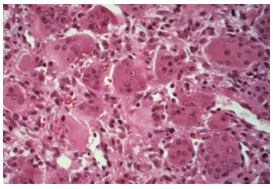
- A telangiectatic osteosarcoma
- An aneurysmal bone cyst
- A giant cell tumor

The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. The diagnosis is giant cell tumor of bone.

The risk of pulmonary metastases in giant cell tumor of bone is 2% to 5%. This phenomenon is called benign metastazing giant cell tumor. The mortality rate from these metastases is 10% to 20%. Spontaneous regression of the pulmonary lesions may occur.

Correct Answer: 2% to 5%

3657. (1282) Q9-1652:



Slide 1

A 28-year-old woman has a destructive distal radius lesion. A biopsy specimen is shown in Slide 1. The most likely diagnosis is:

1) Aneurysmal bone cyst
3) Telangiectatic osteosarcoma
2) Chondroblastoma
5) Unicameral bone cyst
4) Giant cell tumor

The biopsy specimen shows a uniform distribution of multinucleated giant cells in a field of mononuclear cells. There are no atypical nuclear features in the mononuclear cells or the giant cells. The diagnosis is giant cell tumor of bone.Correct Answer: Giant cell tumor

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3658. (1283) Q9-1653:

The cell of origin for malignant fibrous histiocytoma of bone is most likely:

1) A monocyte-macrophage
3) A chondroblast
2) A myofibroblast or fibroblast
5) Hematopoietic
4) An osteoblast

Malignant fibrous histiocytoma is an undifferentiated sarcoma. Tissue cultures show phenotypic features most consistent with myofibroblastic differentiation.Correct Answer: A myofibroblast or fibroblast

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3659. (1284) Q9-1654:

Which of the following describes the histologic features of malignant fibrous histiocytoma of bone:

1) Fascicles of pleomorphic fibroblasts in a herringbone pattern
3) Pleomorphic spindle cells with direct production of osteoid
2) Spindle cells and pleomorphic cells in a storiform pattern
5) Low grade cartilage admixed with undifferentiated spindle cell sarcoma
4) Chondrocytes with round, darkly staining nuclei in a chondroid matrix

Malignant fibrous histiocytoma of bone is histologically characterized by spindle cells and pleomorphic cells in a storiform pattern. The pleomorphic cells display focal myofibroblastic differentiation.Correct Answer: Spindle cells and pleomorphic cells in a storiform pattern

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3660. (1285) Q9-1655:

Which of the following is the most common location of malignant fibrous histiocytoma:

1) Pelvis
3) Femur
2) Tibia
5) Skull
4) Humerus

Malignant fibrous histiocytoma has a similar distribution to other malignant bone tumors. The knee is the most common region affected, and the femur is the most common bone.Correct Answer: Femur

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3661. (1286) Q9-1656:

Which of the following describes the most common radiographic features of malignant fibrous histiocytoma:

1) Metaphyseal, lytic with sclerotic rim, and thinned but intact overlying cortex
3) Lytic bone destruction with cortical disruption
2) Prominent erosions with matrix mineralization (stipples and rings)
5) Discrete lytic punched out lesions in multiple bones
4) Mixed pattern of bone destruction and formation with cortical thickening

The radiographic features of malignant fibrous histiocytoma of bone are nonspecific pattern of bone destruction.

Common features include:

- Lytic bone destruction
- Cortical destruction
- Soft tissue mass

The other answers describe specific lesions:

- Nonossifying fibroma â Metaphyseal, lytic with sclerotic rim, and thinned but intact overlying cortex
- Chondrosarcoma â Prominent erosions with matrix mineralization (stipples and rings)
- Lymphoma â Mixed pattern of bone destruction and formation with cortical thickening
- Myeloma â Discrete lytic punched out lesions in multiple bones

Correct Answer: Lytic bone destruction with cortical disruption

---

3662. (1287) Q9-1657:

Which of the following are the most common sites of metastases in patients with malignant fibrous histiocytoma of bone:

1) Bones
3) Lungs
2) Lymph nodes
5) Bones and lymph nodes
4) Lungs and lymph nodes

The most common site of metastases in malignant fibrous histiocytoma is to the lungs. Metastases to lymph nodes are rare.Correct Answer: Lungs

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3663. (1288) Q9-1658:

Which of the following malignancies often occurs in a preexisting benign bone lesion:

1) Osteosarcoma
3) Fibrosarcoma
2) Angiosarcoma
5) Ewing tumor
4) Malignant fibrous histiocytoma

Malignant fibrous histiocytoma (MFH) is the most common sarcoma to occur in a preexisting benign bone lesion. Approximately 20% of MFHs occur in a preexisting benign bone condition such as bone infarcts, irradiated bone, fibrous dysplasia, and Pagetâs disease.Correct Answer: Malignant fibrous histiocytoma

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3664. (1289) Q9-1659:

Slide 1 **Slide 2** **Slide 3**

A 45-year-old woman has hip discomfort with prolonged sitting, and she feels a mass. The plain radiographs and computerized tomography scan are shown in Slides 1, 2, and 3. The most likely diagnosis is:

1) Parosteal osteosarcoma
3) Osteochondroma
2) Periosteal chondroma
5) Secondary chondrosarcoma
4) Heterotopic ossification

The anteroposterior radiograph shows a lesion in the greater trochanter, and the oblique radiograph shows a bony mass projecting from the proximal femur. The computerized tomography scan shows a lesion arising from the posterior cortical surface, which shares its cortices with the host bone. In addition, the medullary cavity of the proximal femur flows into the lesion. These findings are consistent with an osteochondroma. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- Underlying bone and the osteochondroma have continuous cortices.
- Medullary cavity of the bone and osteochondroma are continuous.

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)

Correct Answer: Osteochondroma

3665. (1290) Q9-1660:

Slide 1 **Slide 2** **Slide 3**

A 45-year-old woman has hip discomfort with prolonged sitting, and she feels a mass. The plain radiographs and computerized tomography scan are shown in Slides 1, 2, and 3. Her symptoms have increased, and she desires surgical treatment. The most appropriate treatment is:

1) Needle biopsy
3) Removal of the mass (excisional biopsy)
2) Incisional biopsy
5) Resection/proximal femoral replacement
4) Intramedullary rod fixation followed by irradiation

The anteroposterior radiograph shows a lesion in the greater trochanter, and the oblique radiograph shows a bony mass projecting from the proximal femur. The computerized tomography scan shows a lesion arising from the posterior cortical surface, which shares its cortices with the host bone. In addition, the medullary cavity of the proximal femur flows into the lesion. These findings are consistent with an osteochondroma. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- Underlying bone and the osteochondroma have continuous cortices.
- Medullary cavity of the bone and osteochondroma are continuous.

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)

The most appropriate treatment is removal of the mass through a posterior approach. Internal fixation may not be necessary.

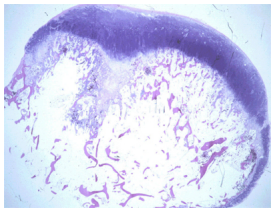
Correct Answer: Removal of the mass (excisional biopsy)

3666. (1291) Q9-1661:

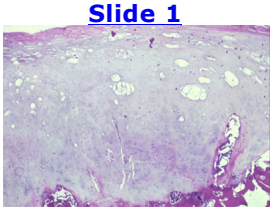
Slide 1

Slide 2

Slide 3



Slide 4



Slide 5

A 45-year-old woman has hip discomfort with prolonged sitting and feels a mass. The plain radiographs, and computerized tomography scan are shown in Slides 1, 2, and 3. Her symptoms have increased and she desires surgical treatment. She undergoes surgical removal and her biopsy specimens are shown in Slides 4 and 5. The diagnosis is:

1) Mesenchymal chondrosarcoma
3) Low grade chondrosarcoma
2) Dedifferentiated chondrosarcoma
5) Osteochondroma
4) Parosteal osteosarcoma

The anteroposterior radiograph shows a lesion in the greater trochanter, and the oblique radiograph shows a bony mass projecting from the proximal femur. The computerized tomography scan shows a lesion arising from the posterior cortical surface, which shares its cortices with the host bone. In addition, the medullary cavity of the proximal femur flows into the lesion. These findings are consistent with an osteochondroma. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- Underlying bone and the osteochondroma have continuous cortices.
- Medullary cavity of the bone and osteochondroma are continuous.

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

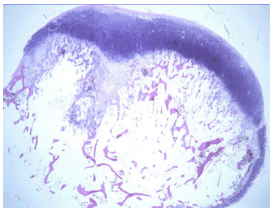
- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)

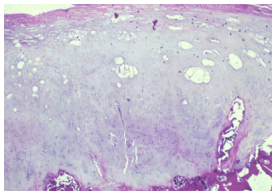
The biopsy specimen shows a lesion with a thin cartilage cap. The high power view shows the typical features of an osteochondroma with a linear arrangement of the chondrocytes.

The lesion is benign. Observation is all that is required.

Correct Answer: Osteochondroma

3667. (1292) Q9-1662:





Slide 1 **Slide 2**

An 18-year-old woman has a hard bony mass over her distal right femur. The plain radiographs showed that this lesion was arising from the surface of the bone. The mass is removed, and the biopsy specimens are shown in Slides 1 and 2. The most likely diagnosis is:

1) Parosteal osteosarcoma
3) Heterotopic ossification
2) Periosteal osteosarcoma
5) Osteochondroma
4) Perisoteal chondroma

The biopsy specimen shows a lesion with a thin cartilage cap. The high power view shows the typical features of an osteochondroma with a linear arrangement of the chondrocytes. This lesion is an osteochondroma.Correct Answer: Osteochondroma

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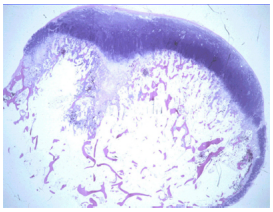
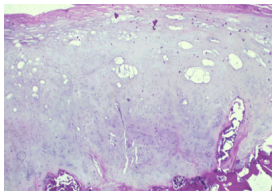
3668. (1293) Q9-1663:





Slide 1 **Slide 2**

An 18-year-old woman has a hard bony mass over her distal right femur. The plain radiographs showed that this lesion was arising from the surface of the bone. The mass is removed, and the biopsy specimens are shown in Slides 1 and 2. Which of the following is the correct treatment:

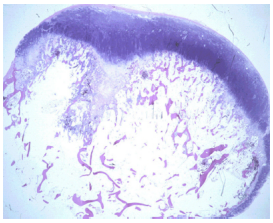
1) Observation
3) Radiation therapy
2) Chemotherapy
5) Chemotherapy and radiation
4) Repeat excision and radiation

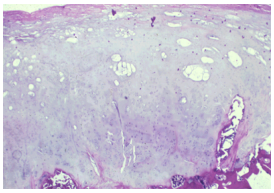
The biopsy specimen shows a lesion with a thin cartilage cap. The high power view shows the typical features of an osteochondroma with a linear arrangement of the chondrocytes. This lesion is an osteochondroma.

Observation is the only treatment needed.

Correct Answer: Observation

3669. (1294) Q9-1664:





Slide 1 **Slide 2**

An 18-year-old woman has a hard mass over her distal femur. The mass is removed, and the biopsy specimens are shown in Slides 1 and 2. The most likely diagnosis is:

1) Parosteal osteosarcoma
3) Periosteal chondroma
2) Periosteal osteosarcoma
5) Heterotopic ossification
4) Osteochondroma

The biopsy specimen shows a lesion with a thin cartilage cap. Notice the blue cartilage matrix in the cartilage cap. The high power view shows the typical features of an osteochondroma with a linear arrangement of the chondrocytes. This lesion is an osteochondroma.Correct Answer: Osteochondroma

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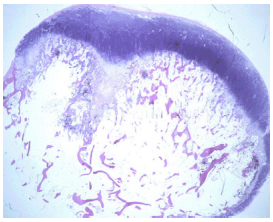
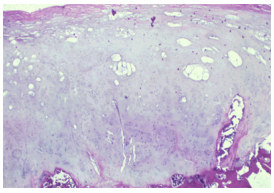
3670. (1295) Q9-1665:





Slide 1 **Slide 2**

An 18-year-old woman has a hard mass over her distal femur. The mass is removed, and the biopsy specimens are shown in Slides 1 and 2. The most appropriate treatment is:

1) Observation
3) Chemotherapy
2) External beam irradiation
5) Amputation
4) External beam irradiation and chemotherapy

The biopsy specimen shows a lesion with a thin cartilage cap. Notice the blue cartilage matrix in the cartilage cap. The high power view shows the typical features of an osteochondroma with a linear arrangement of the chondrocytes.

Observation is the most appropriate treatment.

Correct Answer: Observation

3671. (1296) Q9-1666:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 15-year-old boy has a hard mass over his distal femur. He has pain when playing sporting activities. His plain radiographs are shown in Slides 1 and 2. The axial T1- and T2-weighted images are shown in Slides 3 and 4. The most likely diagnosis is:

1) Parosteal osteosarcoma
3) Periosteal chondroma
2) Periosteal osteosarcoma
5) Heterotopic ossification
4) Osteochondroma

The anteroposterior radiograph shows a lesion projecting from the medial aspect of the distal femur. The magnetic resonance imaging scan shows the cortices of the lesion are continuous with the underlying femur, and the medullary cavity of the lesion is continous with the medullary cavity of the distal femur. These findings are consistent with an osteochondroma. The bony stalk of the osteochondroma is covered by a cap of cartilage. The cartilage cap is low signal on T-weighted images and high signal on T2 weighted imagesa. The thickness of the cartilage cap is approximately 8 mm. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- The underlying bone and the osteochondroma have continuous cortices.
- The medullary cavity of the bone and osteochondroma are continuous.
- The lesion may have a narrow stalk (pedunculated) or a broad base (sessile).

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)
- Magnetic resonance image shows a markedly thickened cap (larger than 1 cm in adults)

This patient has an osteochondroma.

Correct Answer: Osteochondroma

3672. (1297) Q9-1667:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 15-year-old boy has a hard mass over his distal femur. He has pain when playing sporting activities. His plain radiographs are shown in Slides 1 and 2. The axial T1- and T2-weighted images are shown in Slides 3 and 4. The most appropriate treatment is:

1) Needle biopsy
3) Removal of the mass
2) Incisional biopsy
5) Further evaluation with a computerized tomography scan
4) Further evaluation with a technetium bone scan

The anteroposterior radiograph shows a lesion projecting from the medial aspect of the distal femur. The magnetic resonance imaging scan shows the cortices of the lesion are continuous with the underlying femur, and the medullary cavity of the lesion is continous with the medullary cavity of the distal femur. These findings are consistent with an osteochondroma. The bony stalk of the osteochondroma is covered by a cap of cartilage. The cartilage cap is low signal on T2-weighted images. The thickness of the cartilage cap is approximately 8 mm. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- The underlying bone and the osteochondroma have continuous cortices.
- The medullary cavity of the bone and osteochondroma are continuous.
- The lesion may have a narrow stalk (pedunculated) or a broad base (sessile).

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

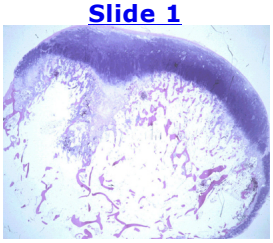
- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)
- Magnetic resonance image shows a markedly thickened cap (larger than 1 cm in adults)

This patient has an osteochondroma. The most appropriate treatment is excision because the patient is symptomatic. Biopsy is not necessary prior to treatment and no further imaging is required.

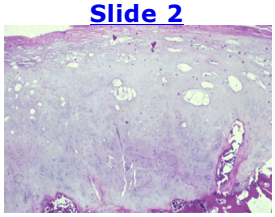
Correct Answer: Removal of the mass

3673. (1298) Q9-1668:

Slide 1



Slide 2



Slide 3

Slide 4

Slide 5

Slide 6

A 15-year-old boy has a hard mass over his distal femur. He has pain when playing sporting activities. His plain radiographs are shown in Slides 1 and 2. The axial T1- and T2-weighted images are shown in Slides 3 and 4. The mass is removed and the biopsy specimens are shown in Slides 5 and 6. The most likely diagnosis is:

1) Parosteal osteosarcoma
3) Periosteal chondroma
2) Periosteal osteosarcoma
5) Osteochondroma
4) Periosteal chondrosarcoma

The anteroposterior radiograph shows a lesion projecting from the medial aspect of the distal femur. The magnetic resonance imaging scan shows the cortices of the lesion are continuous with the underlying femur, and the medullary cavity of the lesion is continous with the medullary cavity of the distal femur. These findings are consistent with an osteochondroma. The bony stalk of the osteochondroma is covered by a cap of cartilage. The cartilage cap is low signal on T2-weighted images. The thickness of the cartilage cap is approximately 8 mm. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- The underlying bone and the osteochondroma have continuous cortices.
- The medullary cavity of the bone and osteochondroma are continuous.
- The lesion may have a narrow stalk (pedunculated) or a broad base (sessile).

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)
- Magnetic resonance image shows a markedly thickened cap (larger than 1 cm in adults)

This patient has an osteochondroma. The biopsy specimen shows a lesion with a thin cartilage cap. The high power view shows the typical features of an osteochondroma with a linear arrangement of the chondrocytes.

Correct Answer: Osteochondroma

3674. (1299) Q9-1669:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 15-year-old boy has a hard mass over his distal femur. He has pain when playing sporting activities. His plain radiographs are shown in Slides 1 and 2. The axial T1- and T2-weighted images are shown in Slides 3 and 4. What is the stage of this lesion according to the system of the Musculoskletal Tumor Society:

1) Stage 1
3) Stage 3
2) Stage 2
5) Stage II
4) Stage I

The anteroposterior radiograph shows a lesion projecting from the medial aspect of the distal femur. The magnetic resonance imaging scan shows the cortices of the lesion are continuous with the underlying femur, and the medullary cavity of the lesion is continous with the medullary cavity of the distal femur. These findings are consistent with an osteochondroma. The bony stalk of the osteochondroma is covered by a cap of cartilage. The cartilage cap is low signal on T2-weighted images. The thickness of the cartilage cap is approximately 8 mm. There is no evidence of malignant change.

The radiographic findings of an osteochondroma are:

- The underlying bone and the osteochondroma have continuous cortices.
- The medullary cavity of the bone and osteochondroma are continuous.
- The lesion may have a narrow stalk (pedunculated) or a broad base (sessile).

Secondary chondrosarcomas may develop in an osteochondroma. The radiographic features are:

- Destruction of the underlying subchondral cortex of the osteochondroma
- Lytic destruction of the cartilage cap
- Formation of a soft tissue mass (often calcified)
- Magnetic resonance image shows a markedly thickened cap (larger than 1 cm in adults)

This patient has an osteochondroma. Because the patient is symptomatic, this lesion is Stage 2.

Remember the Musculoskletal Tumor Society staging system:

Stage 1	Inactive, latent
Stage 2	Active, symptomatic
Stage 3	Aggressive
Â	
Stage I	Low grade malignant
Stage II	High grade malignant
Stage III	Metastatic disease

Correct Answer: Stage 2

3675. (1300) Q9-1670:

Which of the following statements is false regarding liposarcomas:

1) Most liposarcomas occur below the fascia.
3) Liposarcomas rarely occur in children.
2) Lipomas may transform into a liposarcoma
5) Liposarcomas are not induced by irradiation.
4) Reciprocal transformation (chromosome 12 and 16) occurs in myxoid liposarcoma.

Liposarcomas account for approximately 10% to 15% of sarcomas. Some general statements about liposarcomas are listed below:

1. Most liposarcomas occur below the fascia.
2. Superficial liposarcomas have an excellent prognosis.
3. Lipomas do not undergo transformation into liposarcomas.
4. Liposarcomas rarely occur in children.
5. Reciprocal transformation between chromosomes 12 and 16 occurs in myxoid and round cell liposarcoma.
6. Well-differentiated liposarcomas have giant marker and ring chromosome abnormalities with amplification of MDM2, SAS, and GLI genes.
7. Liposarcomas express peroxisome proliferator-activated receptor gamma (PPAR gamma).
8. Liposarcomas are not induced by irradiation.

Correct Answer: Lipomas may transform into a liposarcoma

3676. (1301) Q9-1671:

Which of the following statements is false regarding liposarcomas:

1) Liposarcomas rarely develop from lipomas.
3) Most liposarcomas occur below the deep fascia.
2) Liposarcomas rarely occur in children.
5) Reciprocal transformation (chromosome 12 and 16) occurs in myxoid liposarcoma.
4) Well-differentiated liposarcomas never have chromosomal abnormalities.

Liposarcomas account for approximately 10% to 15% of sarcomas. Some general statements about liposarcomas are listed below:

1. Most liposarcomas occur below the fascia.
2. Superficial liposarcomas have an excellent prognosis.
3. Lipomas do not undergo transformation into liposarcomas.
4. Liposarcomas rarely occur in children.
5. Reciprocal transformation between chromosomes 12 and 16 occurs in myxoid and round cell liposarcoma.
6. Well-differentiated liposarcomas have giant marker and ring chromosome abnormalities with amplification of MDM2, SAS, and GLI genes.
7. Liposarcomas express peroxisome proliferator-activated receptor gamma (PPAR gamma).
8. Liposarcomas are not induced by irradiation.

Correct Answer: Well-differentiated liposarcomas never have chromosomal abnormalities.

3677. (1302) Q9-1672:

Which of the following soft tissue lesions has a characteristic reciprocal transformation between chromosomes 12 and 16:

1) Well-differentiated lipoma-like liposarcoma
3) Intramuscular lipomas
2) Atypical lipoma
5) Pleomorphic liposarcoma
4) Myxoid liposarcoma

Liposarcomas account for approximately 10% to 15% of sarcomas. Some general statements about liposarcomas are listed below.

Liposarcomas may have chromosomal abnormalities:

1. Reciprocal transformation between chromosomes 12 and 16 occurs in myxoid and round cell liposarcoma.
2. Well-differentiated liposarcomas have giant marker and ring chromosome abnormalities with amplification of MDM2, SAS, and GLI genes.
3. Liposarcomas express peroxisome proliferator-activated receptor gamma (PPAR gamma).

Correct Answer: Myxoid liposarcoma

3678. (1303) Q9-1673:

Myxoid liposarcomas have which of the following chromosomal alterations:

1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Reciprocal translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Reciprocal translocation of chromosomes X and 18

Many benign and malignant soft tissue tumors have specific chromosomal abnormalities. A few common abnormalities include:

Well-differentiated liposarcoma	Giant marker and ring chromosomes
Myxoid liposarcoma	Translocation between chromosomes 12 and 16
Ewings/primitive neuroectodermal tumors	Translocation between chromosomes 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Reciprocal translocation between chromosomes 12 and 16

3679. (1304) Q9-1674:

Soft tissue Ewings or primitive neuroectodermal tumors have which of the following cytogenetic abnormalities:

1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Reciprocal translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Reciprocal translocation of chromosomes X and 18

Many benign and malignant soft tissue tumors have specific chromosomal abnormalities. A few common abnormalities include:

Well-differentiated liposarcoma	Giant marker and ring chromosomes
Myxoid liposarcoma	Translocation between chromosomes 12 and 16
Ewings/primitive neuroectodermal tumors	Translocation between chromosomes 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Translocation between chromosomes 11 and 22

3680. (1305) Q9-1675:

Well-differentiated lipoma-like liposarcomas have which of the following characteristic chromosomal alterations:

1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Reciprocal translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Reciprocal translocation of chromosomes X and 18

Many benign and malignant soft tissue tumors have specific chromosomal abnormalities. A few common abnormalities include:

Well-differentiated liposarcoma	Giant marker and ring chromosomes
Myxoid liposarcoma	Translocation between chromosomes 12 and 16
Ewings/primitive neuroectodermal tumors	Translocation between chromosomes 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Giant marker and ring chromosomes

3681. (1306) Q9-1676:

Synovial sarcomas have which of the following chromosomal abnormalities:

1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Reciprocal translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Reciprocal translocation of chromosomes X and 18

Many benign and malignant soft tissue tumors have specific chromosomal abnormalities. A few common abnormalities include:

Well-differentiated liposarcoma	Giant marker and ring chromosomes
Myxoid liposarcoma	Translocation between chromosomes 12 and 16
Ewings/primitive neuroectodermal tumors	Translocation between chromosomes 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Reciprocal translocation of chromosomes X and 18

3682. (1307) Q9-1677:

Myxoid soft tissue chondrosarcomas have which of the following chromosomal alterations:

1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Reciprocal translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Reciprocal translocation of chromosomes X and 18

Many benign and malignant soft tissue tumors have specific chromosomal abnormalities. A few common abnormalities include:

Well-differentiated liposarcoma	Giant marker and ring chromosomes
Myxoid liposarcoma	Translocation between chromosomes 12 and 16
Ewings/primitive neuroectodermal tumors	Translocation between chromosomes 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Translocation between chromosomes 9 and 22

3683. (1308) Q9-1678:

Which of the following most accurately describes the etiology of nonossifying fibromas of bone:

1) Benign neoplasm of histiocytic cells
3) Benign neoplasm of lipoblastic origin
2) Benign neoplasm of fibroblastic origin
5) Benign inflammatory process
4) Variant of normal growth

Nonossifying fibromas of bone are best considered as variants of normal growth. Nonossifying fibromas are rare in children younger than 2 years old, and they commonly occur at the sites of muscle attachment.Correct Answer: Variant of normal growth

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3684. (1309) Q9-1679:

Which of the following are the most common locations of nonossifying fibromas:

1) Femur and humerus
3) Tibia and fibula
2) Femur and tibia
5) Scapula and small bones of the hands and feet
4) Femur and scapula

Nonossifying fibromas most commonly arise in the metaphysis of long bones in close proximity to the physis. As a child grows, the lesion moves away from the physis and extends into the diaphysis. Extension into the epiphysis is rare. More than 55% of nonossifying fibromas occur about the knee. They usually arise from the posterior cortex.

The approximate distribution of nonossifying fibromas is:

- Tibia â 43%
- Femur â 38%
- Fibula â 8%
- Humerus â 5%

Note:
Nonossifying fibromas rarely occur in the radius, ulna, ribs, innominate bone, clavicle, skull, mandible, scapula, and small bones of hand and wrist.

Correct Answer: Femur and tibia

3685. (1310) Q9-1680:

Which of the following describes the radiographic appearance of nonossifying fibromas:

1) Eccentric surface lesion eroding the external cortical surface
3) Small, round lucent lesion with surrounding sclerosis
2) Eccentric, lucent, metaphyseal lesion with sclerotic rim and overlying thinned cortex
5) Radiolucent lesion in proximal medial tibial cortex with tibia vara
4) Saucer-like radiolucent lesion within the cortex with adjacent sclerosis and periostitis

Nonossifying fibromas have the following radiographic features:

- Eccentric
- Metaphyseal
- Sclerotic rim
- Overlying cortex is thinned
- Lesion is based on the cortex

The other descriptions pertain to other bone tumors:

Periosteal chondroma â eccentric lesion eroding the external cortical surface

Osteoid osteoma â small, round lucent lesion with surrounding sclerosis

Cortical desmoid â saucer-like radiolucent lesion within the cortex with adjacent sclerosis and periostitis

Focal fibrocartilaginous dysplasia â radiolucent lesion in proximal medial tibial cortex with tibia vara

Correct Answer: Eccentric, lucent, metaphyseal lesion with sclerotic rim and overlying thinned cortex

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3686. (1311) Q9-1681:

Which of the following describes the histologic features of nonossifying fibromas:

1) Multinucleated giant cells uniformly distributed in a field of mononuclear cells
3) A thin fibrous membrane with scattered inflammatory cells
2) Scattered multinucleated giants cells in a field of mononuclear cells with chondroid areas
5) Pleomorphic stroma with osteoid production
4) Storiform pattern of benign fibroblasts and scattered multinucleated giant cells

Nonossifying fibromas have a characteristic histologic appearance:

- Uniform, benign-appearing fibroblasts in a storiform pattern
- Scattered multinucleated giant cells
- Foam cells in 30% to 50%
- Occasionally hemosiderin
- Occasionally cholesterol clefts

The other descriptions pertain to these lesions: Giant cell tumor â multinucleated giant cells uniformly distributed in a field of mononuclear cells Chondroblastoma â scattered multinucleated giants cells in a field of mononuclear cells with chondroid areas Unicameral bone cyst â a thin fibrous membrane with scattered inflammatory cells Osteosarcoma â pleomorphic stroma with osteoid productionCorrect Answer: Storiform pattern of benign fibroblasts and scattered multinucleated giant cells

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3687. (1312) Q9-1682:

Which of the following statements is true regarding nonossifying fibromas:

1) Most lesions progress in size and require curettage and grafting.
3) Lesions that are greater than 50% the width of the bone and greater than 33 mm in length may be prone to fracture.
2) Aspiration and steroid injection result in rapid resolution.
5) The lesion often begins in the first year of life.
4) The risk of malignancy is related to size and the radiographic margination.

Nonossifying fibromas generally resolve as children become adults. The lesions involute and mineralize. Seldom are nonossifying fibromas present in an adult. The majority of patients can be treated nonoperatively. In a study of 23 patients with fractures, Areata and Peterson found that lesions that occupy less than 50% the width of the bone and are less than 33 mm in length are less prone to fracture.

Other important points to remember:

- The risk of malignancy is almost nonexistent.
- Nonossifying fibromas are never found in children younger than 2 years of age.

Correct Answer: Lesions that are greater than 50% the width of the bone and greater than 33 mm in length may be prone to fracture.

3688. (1313) Q9-1683:

Which of the following conditions has been associated with nonossifying fibromas in a small number of patients:

1) Primary hyperparathyroidism
3) Ventricular septal defect
2) Polycystic kidneys
5) Clubfoot and vertical talus
4) Hypophosphatemic vitamin D refractory rickets and osteomalacia

Nonossifying fibroma is a common benign bone tumor that may rarely be associated with hypophosphatemic vitamin D refractory rickets and osteomalacia. Once the nonossifying fibroma is removed, the rickets resolve.Correct Answer: Hypophosphatemic vitamin D refractory rickets and osteomalacia

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3689. (1314) Q9-1684:

Multiple large and symmetric nonossifying fibromas may occur in Jaffe-Campanacci syndrome. Which of the following also occurs in this condition:

1) CafÃ©-au-lait spots, mental retardation, hypogonadism, and cardiovascular abnormalities
3) Spina bifida and myelomeningocele
2) Radial club hand and atlantoaxial instability
5) Soft tissue angiomas and limb shortening with angular deformity
4) Hypophosphatemic vitamin D refractory rickets and osteomalacia

The Jaffe-Campanacci syndrome consists of:

- Multiple nonossifying fibromas that tend to be large and symmetric. The nonossifying fibromas involve the metaphyses and diaphyses and may extend into the epiphysis.
- CafÃ©-au-lait spots
- Mental retardation
- Hypogonadism
- Ocular abnormalities
- Cardiovascular abnormalities

There should be at least three nonossifying fibromas. Patients who are otherwise normal and have multiple nonossifying fibromas do not have Jaffe-Campanacci syndrome.

Correct Answer: CafÃ©-au-lait spots, mental retardation, hypogonadism, and cardiovascular abnormalities

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3690. (1315) Q9-1685:

Which of the following describes the probable inheritance pattern of Pagetâs disease:

1) Spontaneous mutation in all patients
3) Autosomal dominant
2) Autosomal recessive
5) X-linked dominant
4) X-linked recessive

The inheritance pattern of Pagetâs disease is most likely autosomal dominant in pattern. A first degree relative has a seven times greater chance of developing Pagetâs disease than the general population. The exact inheritance is unknown although the human leucocyte antigen (HLA) locus and chromosome 18q (10,11) have been implicated.Correct Answer: Autosomal dominant

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3691. (1316) Q9-1686:

In which of the following countries is Pagetâs disease most rare:

1) Europe and North America
3) France, Spain, and West Germany
2) Australia and New Zealand
5) China, India, and Malaysia
4) Italy and Greece

Pagetâs disease is common in all countries except China, India, Malaysia, and sub-Saharan Africa.

Pagetâs disease is common in people older than 55 years in the following countries:

- Europe
- North America
- England (4.6%)
- France (2.4%)
- Ireland (0.7 to 1.7%)
- Spain (1.3%)
- West Germany (1.3%)
- Italy (0.5%)
- Greece (0.5%)

Correct Answer: China, India, and Malaysia

3692. (1317) Q9-1687:

Which of the following infections has been linked to the development of Pagetâs disease:

1) Bacterial infection with spirochetes
3) Viral infection with human immunodeficiency virus
2) Viral infection with a paramyxovirus
5) Bacterial infection with Yersinia
4) Bacterial infection with streptococci

Infection with a paramyxovirus has been implicated in Pagetâs disease. Inclusions that resemble viral nucleocapsid have been found with electron microscopy in the nuclei and cytoplasm of osteoclasts in Pagetâs disease. It is still controversial whether the virus belongs to the measles, canine distemper, or respiratory syncytial viruses.Correct Answer: Viral infection with a paramyxovirus

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3693. (1318) Q9-1688:

Which of the following is not elevated in patients with active Pagetâs disease:

1) Urinary total hydroxyproline
3) Serum calcium
2) Serum alkaline phosphatase
5) Urinary deoxypyridinoline
4) Urinary N-telopeptide

In Pagetâs disease, serum and urinary markers reflect the rate of increased bone turnover (bone resorption and bone formation):

Elevated in active Pagetâs disease:

- Serum alkaline phosphatase
- Serum bone-specific alkaline phosphatase
- Urinary hydroxyproline
- Urinary N-telopeptide of collagen
- Urinary deoxypyridinoline

The serum calcium level is usually normal in Pagetâs disease. However, if a patient has active and extensive Pagetâs disease and the individual is immobilized, then the serum calcium level may become elevated.

Correct Answer: Serum calcium

3694. (1319) Q9-1689:

Which of the following bones are rarely affected by Pagetâs disease:

1) Pelvis and femur
3) Femur and tibia
2) Skull and spine
5) Hands and feet
4) Ribs and facial bones

The bones most commonly involved in Pagetâs disease are the pelvis, femur, spine, skull, and tibia.

Less commonly involved bones are the clavicles, scapulae, ribs, and facial bones.

Involvement of the hands and feet is rare in Pagetâs disease.

Correct Answer: Hands and feet

3695. (1320) Q9-1690:

Which of the following tests or procedures is most commonly used to establish the diagnosis of Pagetâs disease:

1) Technetium bone scan
3) Urinary hydroxyproline
2) Serum alkaline phosphatase
5) Plain radiographs
4) Bone biopsy

Plain radiographs are commonly used to diagnose Pagetâs disease. The radiographic features include:

- Enlargement and expansion of the bone
- Coarsened trabeculae
- Cortical thickening
- Lucent and sclerotic changes

Technetium bone scans are sensitive to sites of involvement. In general, at the time of diagnosis, there will not be a change in the number of the involved bones.

Serum alkaline phosphatase level is elevated in approximately 95% of patients. Urinary markers of bone turnovers will also be elevated and include hyrodroxyproline, N-telopeptide, and deoxypyridinoline.

Bone biopsy is seldom required to diagnose Pagetâs disease.

Correct Answer: Plain radiographs

3696. (1321) Q9-1691:

Which of the following biphosphonates is approved for use as an antipagetic medication and may halt both bone resorption by osteoclasts and bone formation by osteoblasts:

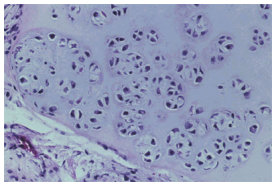
1) Etidronate
3) Alendronate
2) Pamidronate
5) Risedronate
4) Tiludronate

Etidronate was the first biphosphonate used in the treatment of Pagetâs disease. It stopped both osteoclastic resorption and bone formation. Etidronate could only be used for periods of 6 months because prolonged etidronate therapy caused osteomalacia.

The newer diphosphonates are more potent than etidronate and do not inhibit bone formation.

Correct Answer: Etidronate

3697. (1322) Q9-1692:



Slide 1 **Slide 2**

A 38-year-old man has a 4-month history of increasing right hip pain. The plain radiographs are shown in Slide 1 and a biopsy specimen in Slide 2. The most likely diagnosis is:

1) Osteochondroma
3) High grade surface osteosarcoma
2) Periosteal chondroma
5) Parosteal osteosarcoma
4) Periosteal chondrosarcoma

This patient has a large lesion arising from the surface of the bone. There is matrix mineralization of the lesion that shows rings and stipples. This matrix pattern is consistent with a cartilage lesion. The biopsy specimen shows the blue matrix of cartilage and abundant clumps of chondrocytes. This patient has a surface chondrosarcoma. Juxtacortical chondrosarcoma and periosteal chondrosarcoma are names that can be used interchangeably.Correct Answer: Periosteal chondrosarcoma

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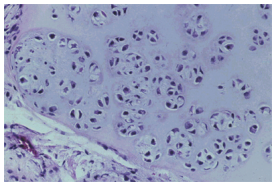
3698. (1323) Q9-1693:



Slide 1 **Slide 2**

A 38-year-old man has a 4-month history of increasing right hip pain. The plain radiographs are shown in Slide 1 and a biopsy specimen in Slide 2. The most appropriate treatment is:

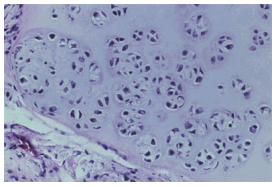
1) Observation
3) Chemotherapy and external beam irradiation
2) Preoperative chemotherapy followed by surgical resection
5) Wide surgical resection and reconstruction
4) External beam irradiation alone

This patient has a large lesion arising from the surface of the bone. There is matrix mineralization of the lesion that shows rings and stipples. This matrix pattern is consistent with a cartilage lesion. The biopsy specimen shows the blue matrix of cartilage and abundant clumps of chondrocytes. This patient has a surface chondrosarcoma. Juxtacortical chondrosarcoma and periosteal chondrosarcoma are names that can be used interchangeably.

The most appropriate treatment is wide surgical resection and reconstruction. The reconstruction can be performed with a custom prosthesis or an allograft prosthetic composite.

Correct Answer: Wide surgical resection and reconstruction

3699. (1324) Q9-1694:



Slide 1 **Slide 2**

A 38-year-old man has a 4-month history of increasing right hip pain. The plain radiographs are shown in Slide 1 and a biopsy specimen in Slide 2. The most likely cause of his hip pain is:

1) A post-traumatic condition
3) A benign neoplasm
2) An infectious process
5) A developmental condition
4) A malignant neoplasm

This patient has a large lesion arising from the surface of the bone. There is matrix mineralization of the lesion that shows rings and stipples. This matrix pattern is consistent with a cartilage lesion. The biopsy specimen shows the blue matrix of cartilage and abundant clumps of chondrocytes. This patient has a surface chondrosarcoma. Juxtacortical chondrosarcoma and periosteal chondrosarcoma are names that can be used interchangeably.

This patient has a malignant bone condition. This particular radiographic appearance can be misinterpreted as a benign condition:

- Posttraumatic condition: Heterotopic ossification
- Infectious process: Osteomyelitis
- Benign neoplasm: Osteochondroma

Correct Answer: A malignant neoplasm

3700. (1325) Q9-1695:

Which of the following is a common finding in patients with tumoral calcinosis:

1) Hypercalcemia
3) Hyperphosphatemia
2) Elevated alkaline phosphatase
5) Hypercalciuric
4) Hypocalcemia

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

- Radiographically: The masses are composed of heavy, amorphous calcification in nodules.
- Laboratory:
    1. Serum calcium normal
    2. Serum alkaline phosphatase normal
    3. Urine calcium is low
    4. Serum phosphate is often high

When symptomatic, the masses are excised.

Correct Answer: Hyperphosphatemia

3701. (1326) Q9-1696:

Which of the following statements is false concerning tumoral calcinosis:

1) Most patients are white.
3) The periarticular masses are extracapsular.
2) Serum calcium levels are usually normal.
5) The most common inheritance is autosomal recessive.
4) Serum phosphate levels are high.

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

- Radiographically: The masses are composed of heavy, amorphous calcification in nodules.
- Laboratory:
    1. Serum calcium normal
    2. Serum alkaline phosphatase normal
    3. Urine calcium is low
    4. Serum phosphate is often high

When symptomatic, the masses are excised.

Correct Answer: Most patients are white.

3702. (1327) Q9-1697:

Which of the following statements is false concerning tumoral calcinosis:

1) Most patients are black.
3) The periarticular masses are intracapsular and restrict motion.
2) Serum calcium levels are usually normal.
5) The most common inheritance is autosomal recessive.
4) Serum phosphate levels are high.

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

- Radiographically: The masses are composed of heavy, amorphous calcification in nodules.
- Laboratory:
    1. Serum calcium normal
    2. Serum alkaline phosphatase normal
    3. Urine calcium is low
    4. Serum phosphate is often high

When symptomatic, the masses are excised.

Correct Answer: The periarticular masses are intracapsular and restrict motion.

3703. (1328) Q9-1698:

Which of the following describes the histopathology of tumoral calcinosis:

1) Malignant stromal cells with direct osteoid production
3) Foreign-body granuloma reactions forming multilocular, cystic structures
2) Lymphocytes between edematous muscle fibers and angiogenic proliferative tissue
5) Zonal pattern with mature bone at periphery and immature tissue at periphery
4) Biphasic with epithelial and fibrous cells

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

The histologic features are:

- Foreign-body granuloma that react with multilocular, cystic structures
- Cysts with tough connective tissue walls
- Mature lesions filled with calcareous material (viscous milky fluid)

The other answers refer to:

- Malignant stromal cells with direct osteoid production: osteosarcoma
- Lymphocytes between edematous muscle fibers and angiogenic proliferative tissue: fibrodysplasia (myositis) ossificans progressiva
- Biphasic with epithelial and fibrous cells: synovial sarcoma
- Zonal pattern with mature bone at periphery and immature tissue at periphery: heterotopic ossification (myositis ossificans)

Correct Answer: Foreign-body granuloma reactions forming multilocular, cystic structures

---

3704. (1329) Q9-1699:

The treatment of tumoral calcinosis is:

1) Excision with an intralesional or marginal margin
3) Wide excision and external beam irradiation
2) Wide excision with a cuff of normal muscle
5) Preoperative external beam irradiation followed with wide excision
4) Preoperative chemotherapy and wide excision

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

- Radiographically: The masses are composed of heavy, amorphous calcification in nodules.
- Laboratory:
    1. Serum calcium normal
    2. Serum alkaline phosphatase normal
    3. Urine calcium is low
    4. Serum phosphate is often high

When symptomatic, the masses are excised. This lesion is benign and removal of normal tissue and radiation therapy are not necessary.

Correct Answer: Excision with an intralesional or marginal margin

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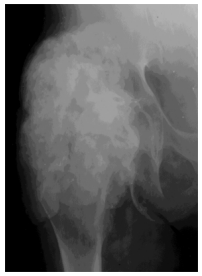
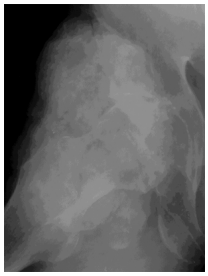
3705. (1330) Q9-1700:





Slide 1 **Slide 2**

A 20-year-old woman has a large mass over the right hip. An anteroposterior and oblique radiographs are shown in Slides 1 and 2. The most likely diagnosis is:

1) Parosteal osteosarcoma
3) Synovial sarcoma
2) Periosteal osteosarcoma
5) Fibrodysplasia ossificans progressiva
4) Tumoral calcinosis

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

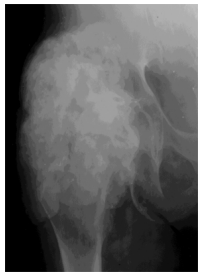
- Radiographically: The masses are composed of heavy, amorphous calcification in nodules.
- Laboratory:
    1. Serum calcium normal
    2. Serum alkaline phosphatase normal
    3. Urine calcium is low
    4. Serum phosphate is often high

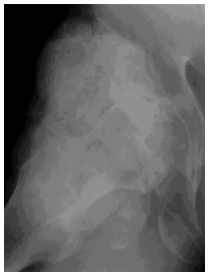
When symptomatic, the masses are excised. This lesion is benign and removal of normal tissue and radiation therapy are not necessary.

Notice the lobules of amorphous calcification that are centered about the hip joint. This is the characteristic appearance of tumoral calcinosis.

Correct Answer: Tumoral calcinosis

3706. (1331) Q9-1701:





Slide 1 **Slide 2**

A 20-year-old patient who is otherwise healthy has a soft mass over her hip. The mass has formed over the past 2 years. The radiographs are shown in Slides 1 and 2. Which of the following would be a common finding:

1) Hypercalcemia
3) Hyperphosphatemia
2) Elevated alkaline phosphatase
5) Hypercalciuric
4) Hypocalcemia

Notice the lobules of amorphous calcification that are centered about the hip joint. This is the characteristic appearance of tumoral calcinosis.

Tumoral calcinosis is a heritable condition that is characterized by periarticular metastatic calcification. Most patients are black, and the inheritance is usually autosomal recessive. Metastatic calcifications occur around joints and in the skin, marrow, teeth, and blood vessels. The periarticular masses may grow quite large and are attached to the fascia, but they are extra-articular. The masses may occur at the shoulder, hip, and elbow.

- Radiographically: The masses are composed of heavy, amorphous calcification in nodules.
- Laboratory:
    1. Serum calcium normal
    2. Serum alkaline phosphatase normal
    3. Urine calcium is low
    4. Serum phosphate is often high

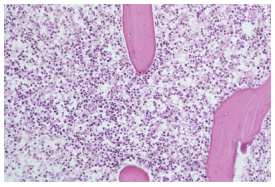
Correct Answer: Hyperphosphatemia

3707. (1332) Q9-1702:

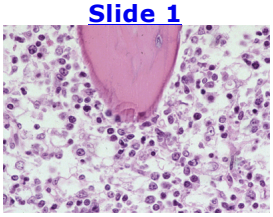
Slide 1

Slide 2

Slide 3



Slide 4



Slide 5

A 50-year-old woman has a 1-year history of moderate to severe pain in the tibia. Her plain radiographs are shown in Slide 1, and the axial and sagittal T1-weighted images in Slides 2 and 3. Low- and high-power hematoxylin and eosin biopsy specimens are shown in Slides 4 and 5. The most likely diagnosis based upon the imaging studies and biopsy specimen is:

1) Metastatic bone disease
3) Malignant fibrous histiocytoma
2) Multiple myeloma
5) Chondrosarcoma
4) Lymphoma

The lateral radiograph shows bone destruction and formation over a long segment of the tibia. There is cortical thickening and areas of bone destruction. The T1-weighted images show replacement of the marrow with low signal intensity. The normal marrow is high signal (white) and the tumor is low signal (dark). The biopsy shows a mixture of large and small blue cells. This is the histologic appearance of lymphoma.

Note that the other choices have characteristic histologic appearances:

- Metastatic bone disease: epithelial cells organized in clusters in a fibrous background
- Multiple myeloma: sheets of plasma cells with an eccentric nucleus with peripheral chromatin. There is also perinuclear clearing, or a halo, where the Golgi apparatus is located.
- Chondrosarcoma: atypical chondrocytes in a blue chondroid matrix
- Malignant fibrous histiocytoma: fascicles of fibroblasts and histiocytes in a storiform pattern

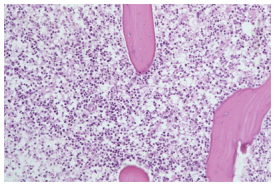
Correct Answer: Lymphoma

3708. (1333) Q9-1703:

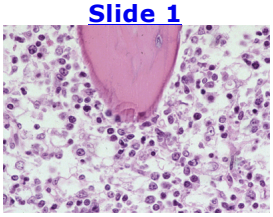
Slide 1

Slide 2

Slide 3



Slide 4



Slide 5

A 50-year-old woman has a 1-year history of moderate to severe pain in the tibia. Her plain radiographs are shown in Slide 1, and the axial and sagittal T1-weighted images in Slides 2 and 3. Low- and high-power hematoxylin and eosin biopsy specimens are shown in Slides 4 and 5. Which of the following would be the most appropriate treatment:

1) Above the knee amputation
3) Preoperative chemotherapy followed by resection/reconstruction
2) Wide resection and custom tibial knee replacement
5) Curettage and cement augmentation
4) Chemotherapy and external beam irradiation

The lateral radiograph shows bone destruction and formation over a long segment of the tibia. There is cortical thickening and areas of bone destruction. The T1-weighted images show replacement of the marrow with low signal intensity. The normal marrow is high signal (white) and the tumor is low signal (dark). The biopsy shows a mixture of large and small blue cells. This is the histologic appearance of lymphoma.

Note that the other choices have characteristic histologic appearances:

- Metastatic bone disease: epithelial cells organized in clusters in a fibrous background
- Multiple myeloma: sheets of plasma cells with an eccentric nucleus with peripheral chromatin. There is also perinuclear clearing, or a halo, where the Golgi apparatus is located.
- Chondrosarcoma: atypical chondrocytes in a blue chondroid matrix
- Malignant fibrous histiocytoma: fascicles of fibroblasts and histiocytes in a storiform pattern

The treatment of lymphoma of bone in the adult is generally chemotherapy and external beam irradiation. Surgery is usually reserved for fractures.

Correct Answer: Chemotherapy and external beam irradiation

3709. (1334) Q9-1704:

Which of the following tumors affects young adults and commonly occurs in the fingers, hands, and forearms:

1) Synovial sarcoma
3) Malignant fibrous histiocytoma
2) Liposarcoma
5) Epithelioid sarcoma
4) Fibrosarcoma

Epithelioid sarcoma is a morphologically distinctive neoplasm that is commonly confused with other conditions such as granulomas, granuloma annulare, ulcerating squamous cell carcinoma, and synovial sarcoma. Epithelioid sarcoma occurs in young people (10-35 years old, median age 26). The most common locations include the fingers, hands, and forearms.

Sites of epithelioid sarcoma:

- Fingers, hands, and forearms
- Knee and lower leg (especially pretibial area)
- Buttocks and thigh
- Shoulder and arm
- Ankle, foot, and toe

Correct Answer: Epithelioid sarcoma

3710. (1335) Q9-1705:

Which of the following describes a common clinical presentation of an epithelioid sarcoma:

1) A large mass in the posterior thigh
3) A soft, subcutaneous mass
2) A large mass adjacent to the bursal knee structures
5) A large mass on the lateral border of the foot
4) An ulcerated nodule on the hand

Epithelioid sarcoma is a morphologically distinctive neoplasm that is commonly confused with other conditions such as granulomas, granuloma annulare, ulcerating squamous cell carcinoma, and synovial sarcoma. Epithelioid sarcoma occurs in young people (10-35 years old, median age 26). The most common locations include the fingers, hands, and forearms.

A common clinical presentation is an ulcerated nodule on the hand.

Sites of epithelioid sarcoma:

- Fingers, hands, and forearms
- Knee and lower leg (especially pretibial area)
- Buttocks and thigh
- Shoulder and arm
- Ankle, foot, and toe

The other answers describe common clinical presentations of several tumors:

- Malignant fibrous histiocytoma â A large mass in the posterior thigh
- Synovial sarcoma â A large mass adjacent to the bursal knee structures
- Lipoma â A soft, subcutaneous mass
- Synovial sarcoma â A soft, subcutaneous mass

Correct Answer: An ulcerated nodule on the hand

3711. (1336) Q9-1706:

Which of the following describes the histologic appearance of epithelioid sarcoma:

1) Storiform pattern of pleomorphic spindle cells and histiocytes
3) Epithelial cells and spindle cells
2) Herringbone pattern of spindle cells
5) Small blue cells in an alveolar pattern
4) Nodules with central necrosis and ovoid or polygonal cells with eosinophilic cytoplasm

There are several histologic features of epithelioid sarcoma:

- Nodular growth with central necrosis
- Ovoid or polygonal cells with deeply eosinophilic cytoplasm

Histologically, the cells may lack pleomorphism and may be confused with granulomas, granuloma annulare, squamous cell carcinoma, necrotizing infectious granuloma, necrobiosis lipoidica, and rheumatoid nodules.

Correct Answer: Nodules with central necrosis and ovoid or polygonal cells with eosinophilic cytoplasm

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3712. (1337) Q9-1707:

Which of the following forms of rhabdomyosarcoma has a poor prognosis:

1) Botryoid
3) Embryonal
2) Spindle cell
5) Rhabdoid
4) Alveolar

Alveolar rhabdomyosarcoma carries the worse prognosis.

Superior prognosis

Botryoid rhabdomyosarcoma
Spindle cell rhabdomyosarcoma

Intermediate prognosis

Embryonal rhabdomyosarcoma

Unevaluable prognosis

Rhabdomyosarcoma with rhabdoid features

Correct Answer: Alveolar

3713. (1338) Q9-1708:

Which of the following is the most common soft tissue tumor of infancy and childhood:

1) Rhabdomyosarcoma
3) Nodular fasciitis
2) Hemangioma
5) Synovial sarcoma
4) Tendon sheath fibroma

Hemangiomas are the most common soft tissue tumors in infancy and childhood.

Rhabdomyosarcoma is the most common sarcoma in children and synovial sarcoma is the most common soft tissue sarcoma of the foot and ankle.

Correct Answer: Hemangioma

3714. (1339) Q9-1709:

Which of the following is a typical radiographic finding in intramuscular hemangiomas:

1) Nodules of amorphous calcification
3) Small round phleboliths
2) Dense, cloudy mineralization
5) Rounded or ovoid radiolucency
4) Nodules with rings and stipples

Hemangiomas may show small round phleboliths. These phleboliths are similar in appearance to those found in the pelvic veins.

The other answers describe specific entities:

- Tumoral calcinosis â Nodules of amorphous calcification
- Osteosarcoma â Dense, cloudy mineralization
- Chondromas â Nodules with rings and stipples
- Deep lipoma â Rounded or oval radiolucency

Correct Answer: Small round phleboliths

3715. (1340) Q9-1710:

A 15-year-old girl has a 2-year history of atraumatic, recurrent episodes of pain, swelling, and joint effusions. Based upon the history, the most likely diagnosis is:

1) Synovial sarcoma
3) Synovial hemangioma
2) Osteonecrosis
5) Rhabdomyosarcoma
4) Fibroma of tendon sheath

Synovial hemangiomas are an uncommon cause of joint pain in children. When they do occur, the presentation is atraumatic, recurrent episodes of pain, swelling, and joint effusions.

Pathologically:

- Synovial hemangiomas are cavernous hemangiomas. The vessels are separated by an edematous, myxoid, or focally hyalinized matrix.
- The synovium has a villous configuration over the hemangioma and the synovium has large amounts of hemosiderin pigment.

Treatment of synovial hemangiomas is excision.

Correct Answer: Synovial hemangioma

3716. (1341) Q9-1711:

Which of the following has the highest risk of recurrence following surgical excision:

1) Nodular fasciitis
3) Intramuscular lipoma
2) Schwannoma
5) Angiolipoma
4) Intramuscular hemangioma

Intramuscular hemangiomas have an extremely high local failure rate, 20% to >50%. Surgery must be avoided if possible. Symptomatic treatment includes nonsteroidal anti-inflammatory drugs, compression stockings, and activity modification. Embolization or sclerosing therapy is the mainstay of current treatment.Correct Answer: Intramuscular hemangioma

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3717. (1342) Q9-1712:

Which of the following is the most common soft tissue sarcoma in adults:

1) Liposarcoma
3) Synovial sarcoma
2) Malignant fibrous histiocytoma
5) Clear cell sarcoma
4) Epithelioid sarcoma

Malignant fibrous histiocytoma is the most common soft tissue sarcoma in adults, followed by liposarcoma.Correct Answer: Malignant fibrous histiocytoma

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3718. (1343) Q9-1713:

Which of the following is the most common form of malignant fibrous histiocytoma:

1) Storiform-pleomorphic
3) Giant cell
2) Myxoid
5) Angiomatoid fibrous histiocytoma
4) Inflammatory

The storiform-pleomorphic type is the most common form of malignant fibrous histiocytoma.

- Myxoid: Second most common, accounts for 25%
- Giant cell: Contains numerous osteoclast-like giant cells
- Inflammatory: Most common in the retroperitoneum

Correct Answer: Storiform-pleomorphic

3719. (1344) Q9-1714:

Which of the following is the most common location for malignant fibrous histiocytoma:

1) Hand
3) Retroperitoneum
2) Foot and ankle
5) Chest wall
4) Thigh

The most common location of malignant fibrous histiocytoma is the thigh.

Remember these common locations for the following tumors:

- Synovial sarcoma â Foot/ankle
- Epithelioid sarcoma â Hand
- Melanoma â Plantar surface of the foot

Correct Answer: Thigh

3720. (1345) Q9-1715:

Which of the following describes the histologic features of malignant fibrous histiocytoma:

1) Fascicles of spindle cells in a herringbone pattern
3) Epithelial cells in a gland-like pattern and spindle cells
2) Spindle cells in short fascicles in a storiform pattern around slit-like vessels
5) Small blue cells in an alveolar pattern
4) Nodules of epithelial cells with central necrosis

The histologic pattern of malignant fibrous histiocytoma includes:

- Spindle cells in short fascicles in a storiform, or cartwheel, pattern arranged around slit-like vessels.
- Pleomorphic areas that contain plump fibroblasts and rounded histiocytes.
- A large number of giant cells with hyperchromatic nuclei.

The other answers describe the following soft tissue tumors:

- Synovial sarcoma â Epithelial cells in a gland-like pattern and spindle cells
- Fibrosarcoma â Fascicles of spindle cells in a herringbone pattern
- Epithelioid sarcoma â Nodules of epithelial cells with central necrosis
- Rhabdomyosarcoma â Small blue cells in an alveolar pattern

Correct Answer: Spindle cells in short fascicles in a storiform pattern around slit-like vessels

---

3721. (1346) Q9-1716:

Synovial sarcomas occur in close association to all of the following locations except:

1) Tendon sheaths
3) Joint capsules
2) Bursae
5) Ligaments and fascial structures
4) Within synovial joints

Synovial sarcomas rarely occur within a joint cavity (less than 5% of cases).

Synovial sarcomas are closely associated to:

- Tendon sheaths
- Bursae
- Joint capsules
- Ligaments, fascial structures, and aponeuroses
- Parapharyngeal region
- Abdominal wall
- Pleura
- Heart

Correct Answer: Within synovial joints

3722. (1347) Q9-1717:

Which of the following tumors may have multiple small, spotty radiopacities (focal calcification):

1) Malignant fibrous histiocytoma
3) Fibrosarcoma
2) Liposarcoma
5) Epitheloid sarcoma
4) Synovial sarcoma

Synovial sarcomas may have multiple small, spotty radiopacities caused by focal calcification (less often bone) in 15% to 20% of cases.Correct Answer: Synovial sarcoma

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3723. (1348) Q9-1718:

Which of the following describes the histologic appearance of a synovial sarcoma:

1) Storiform pattern of pleomorphic spindle cells and histiocytes
3) Spindle cells in a herringbone pattern
2) Epithelial cells and fibroblast-like spindle cells
5) Small blue cells in an alveolar pattern
4) Nodules of epithelial cells with central necrosis

Synovial sarcoma commonly has a bimorphic pattern with epithelial cells and fibroblast-like spindle cells. The histological characteristics include:

- Epithelial cells: Large, round or oval, vesicular nuclei and abundant pale staining cytoplasm. The cells are in solid cords, nests, and glandular structures or cyst-like structures.
- Spindle cells: Well-oriented, rather plump, spindle cell-shaped cells with small amounts of indistinct cytoplasm and oval dark staining nuclei. Cells form solid compact sheaths.

Correct Answer: Epithelial cells and fibroblast-like spindle cells

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3724. (1349) Q9-1719:

Which of the following cytogenetic findings is common in synovial sarcoma:

1) Balanced reciprocal translocation (t[X;18][p11.2;q11.2])
3) Reciprocal transformation between chromosome 12 and 16
2) Ring and giant chromosomes
5) Translocation between 11 and 22
4) Translocation between chromosomes 9 and 22

Approximately 90% of synovial sarcomas have a balanced reciprocal translocation (t[X;18][p11.2;q11.2]) that occurs between chromosomes X and 18.

Many benign and malignant soft tissue tumors have specific chromosomal abnormalities:

Well-differentiated liposarcoma Myxoid liposarcoma	Giant marker and ring chromosomes Translocation between chromosomes 12 and 16
Ewings/primitive neuroectodermal tumors	Translocation between chromosome 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Balanced reciprocal translocation (t[X;18][p11.2;q11.2])

3725. (1350) Q9-1720:

Which of the following is an unfavorable prognostic factor in patients with synovial sarcoma:

1) Age younger than 25 years
3) Absence of poorly differentiated zones
2) Extensively calcified lesions
5) Distal extremity location
4) Size larger than 5 cm

Favorable prognostic factors in synovial sarcoma include:

- Size smaller than 5 cm
- Age younger than 25 years
- Absence of poorly differentiated areas
- Extensively calcified lesions
- Distal extremity location

Unfavorable prognostic factors include:

- Size larger than 5 cm
- Age older than 40 years
- Poorly differentiated areas

Correct Answer: Size larger than 5 cm

3726. (1351) Q9-1721:

Which of the following is a favorable prognostic sign in patients with a synovial sarcoma:

1) Size larger than 5 cm
3) Extensively sclerotic lesion
2) Proximal location
5) Age older than 40 years
4) Extensive tumor necrosis

Favorable prognostic factors in synovial sarcoma include:

- Size smaller than 5 cm
- Age younger than 25 years
- Absence of poorly differentiated areas
- Extensively calcified lesions
- Distal extremity location

Unfavorable prognostic factors include:

- Size larger than 5 cm
- Age older than 40 years
- Poorly differentiated areas

Histologic features associated with a poor prognosis include:

- Presence of rhabdoid cells
- Extensive tumor necrosis
- High mitotic index (greater than 10 mitoses per high power field)
- High nuclear grade

Correct Answer: Extensively sclerotic lesion

3727. (1352) Q9-1722:

Slide 1 **Slide 2**

A 12-year-old boy has a 2-week history of increasing knee pain. He is active in cross-country running. Anteroposterior and oblique radiographs are shown in Slides 1 and 2. The most likely diagnosis is:

1) Giant cell tumor
3) Osteochondroma
2) Chondroblastoma
5) Periosteal chondroma
4) Nonossifying fibroma

This lesion is a nonossifying fibroma and has a characteristic appearance which includes the following radiographic features:

- Eccentric
- Metaphyseal
- Sclerotic rim
- Overlying cortex is thinned
- Lesion is based on the cortex

Correct Answer: Nonossifying fibroma

3728. (1353) Q9-1723:

Slide 1 **Slide 2**

A 12-year-old boy has a 2-week history of increasing knee pain. He is active in cross-country running. Anteroposterior and oblique radiographs are shown in Slides 1 and 2. The most likely cause of the knee pain is:

1) Tumor destruction of the bone
3) Stress fracture
2) Pressure within the medullary cavity
5) Growing pains
4) Physeal separation

There is a stress fracture present on the lateral superior border of the lesion. Notice the condensation of bone in this area. This lesion is a nonossifying fibroma and has a characteristic appearance which includes the following radiographic features:

Nonossifying fibromas have the following radiographic features:

- Eccentric
- Metaphyseal
- Sclerotic rim
- Overlying cortex is thinned
- Lesion is based on the cortex

Correct Answer: Stress fracture

3729. (1354) Q9-1724:

Slide 1

Which of the following conditions is rarely associated with the lesion shown in Slide 1:

1) Primary hyperparathyroidism
3) Polycystic kidneys
2) Hypophosphatemic vitamin D refractory rickets and osteomalacia
5) Atlantoaxial instability
4) Clubfoot and vertical talus

Nonossifying fibroma is a common benign bone tumor that is rarely associated with hypophosphatemic vitamin D refractory rickets and osteomalacia. Once the nonossifying fibroma is removed, the rickets resolve.

Other tumors that may be associated with hypophosphatemic vitamin D refractory rickets and osteomalacia include:

- Giant cell tumor
- Osteoblastoma
- Fibrous dysplasia
- Hemangiopericytoma

Correct Answer: Hypophosphatemic vitamin D refractory rickets and osteomalacia

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3730. (1355) Q9-1725:

Slide 1 **Slide 2**

A 12-year-old boy has a 2-week history of increasing knee pain. He is active in cross-country running. Anteroposterior and oblique radiographs are shown in Slides 1 and 2. Which of the following is the best form of treatment:

1) Wide resection and reconstruction
3) Chemotherapy and external beam irradiation
2) Preoperative chemotherapy, wide resection, and reconstruction
5) Curettage and bone grafting
4) Above the knee disarticulation

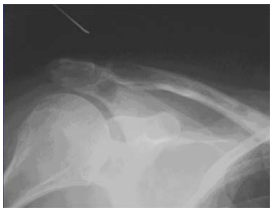
The diagnosis in this case can be made without a biopsy based upon the radiographs.

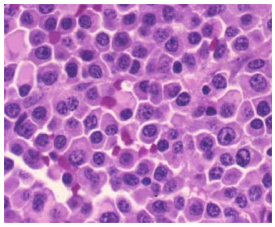
Nonossifying fibromas have the following radiographic features:

- Eccentric
- Metaphyseal
- Sclerotic rim
- Overlying cortex is thinned
- Lesion is based on the cortex

Correct Answer: Curettage and bone grafting

3731. (1356) Q9-1726:





Slide 1 **Slide 2**

A 55-year-old man presents with a 4-month history of shoulder discomfort. The plain radiographs are shown in Slide 1 and a biopsy in Slide 2. The most likely diagnosis is:

1) Metastatic bone disease
3) Multiple myeloma
2) Lymphoma
5) Malignant fibrous histiocytoma
4) Chondrosarcoma

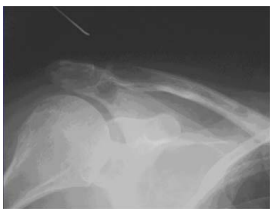
The plain radiograph of the shoulder shows lytic lesions in the scapular spine, distal clavicle, and the proximal third of the clavicle. There is an elliptical erosion in the proximal clavicle. These three lesions suggest a diagnosis of metastatic bone disease or multiple myeloma. The biopsy specimen shows plasma cells. The plasma cells have these characteristic features:

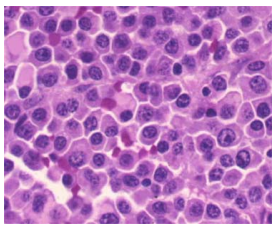
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

The most likely diagnosis for this patient is multiple myeloma.

Correct Answer: Multiple myeloma

3732. (1357) Q9-1727:





Slide 1 **Slide 2**

A 55-year old man presents with a 4-month history of shoulder discomfort. The plain radiographs are shown in Slide 1 and a biopsy in Slide 2. The most appropriate treatment would be:

1) Resection of the clavicle and scapula spine en bloc
3) Systemic chemotherapy
2) Curettage and bone grafting
5) Subacromial cortisone injection
4) Forequarter amputation

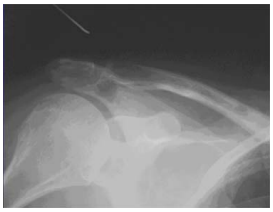
The plain radiograph of the shoulder shows lytic lesions in the scapular spine, distal clavicle, and the proximal third of the clavicle. There is an elliptical erosion in the proximal clavicle. These three lesions suggest a diagnosis of metastatic bone disease or multiple myeloma. The biopsy specimen shows plasma cells. The plasma cells have these characteristic features:

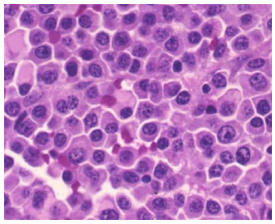
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

The diagnosis is multiple myeloma. The treatment of multiple myeloma is systemic chemotherapy (usually prednisone and an alkylating agent). External beam radiation is used to control pain and stop progressing lesions. When there is no risk of impending fracture, chemotherapy treatment is used first.

Correct Answer: Systemic chemotherapy

3733. (1358) Q9-1728:





Slide 1 **Slide 2**

A 55-year-old man presents with a 4-month history of shoulder discomfort. The plain radiographs are shown in Slide 1 and a biopsy in Slide 2. Which of the following tests is recommended to assess the extent of this condition (staging studies):

1) Computerized tomography scan and technetium bone scan
3) Skeletal survey and bone marrow aspiration
2) Technetium bone scan alone
5) Positron emision tomography scan of the brain and computerized tomography of the chest
4) Computerized tomography of the chest and abdomen and technetium bone scan

The plain radiograph of the shoulder shows lytic lesions in the scapular spine, distal clavicle, and the proximal third of the clavicle. There is an elliptical erosion in the proximal clavicle. These three lesions suggest a diagnosis of metastatic bone disease or multiple myeloma. The biopsy specimen shows plasma cells. The plasma cells have these characteristic features:

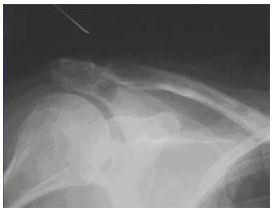
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

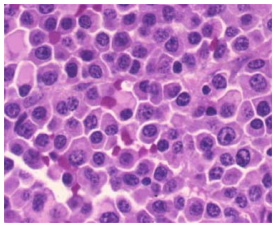
The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, and chemistry studies including kidney function and serum calcium determination.

Technetium bone scans have a high false-negative rate and are not used in the staging process. Computerized tomography scans and brain scans are not routinely used.

Correct Answer: Skeletal survey and bone marrow aspiration

3734. (1359) Q9-1729:





Slide 1 **Slide 2**

A 55-year-old man presents with a 4-month history of shoulder discomfort. The plain radiographs are shown in Slide 1 and a biopsy in Slide 2. Which of the following tests is not recommended to assess the extent of this condition (staging studies):

1) Bone marrow biopsy
3) Serum creatinine and blood urea nitrogen
2) Serum calcium level
5) Skeletal survey
4) Technetium bone scan

The plain radiograph of the shoulder shows lytic lesions in the scapular spine, distal clavicle, and the proximal third of the clavicle. There is an elliptical erosion in the proximal clavicle. These three lesions suggest a diagnosis of metastatic bone disease or multiple myeloma. The biopsy specimen shows plasma cells. The plasma cells have these characteristic features:

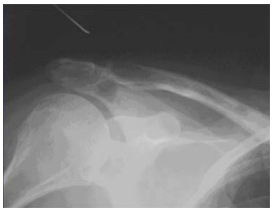
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

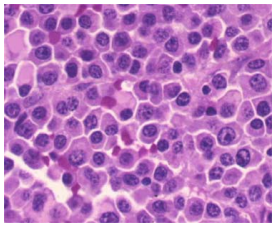
The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, and chemistry studies including kidney function and serum calcium determination.

Technetium bone scans have a high false-negative rate and are not used in the staging process. Computerized tomography scans and brain scans are not routinely used.

Correct Answer: Technetium bone scan

3735. (1360) Q9-1730:





Slide 1 **Slide 2**

A 55-year old man presents with a 4-month history of shoulder discomfort. The plain radiographs are shown in Slide 1 and a biopsy in Slide 2. Which of the following tests would be ordered to further confirm the diagnosis:

1) Serum protein electrophoresis
3) Urine hydroxyproline levels
2) Serum alkaline phosphatase level
5) Serum prostate specific antigen level
4) Serum parathyroid hormone level

The plain radiograph of the shoulder shows lytic lesions in the scapular spine, distal clavicle, and the proximal third of the clavicle. There is an elliptical erosion in the proximal clavicle. These three lesions suggest a diagnosis of metastatic bone disease or multiple myeloma. The biopsy specimen shows plasma cells. The plasma cells have these characteristic features:

- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

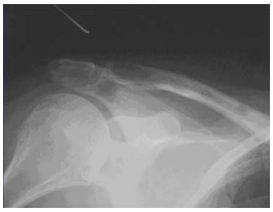
The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, hemoglobin level, and chemistry studies including kidney function and serum calcium determination.

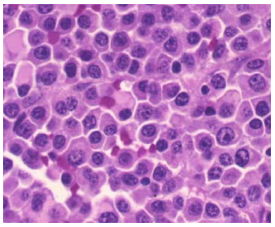
Serum protein electrophoresis is performed to assess the amount of abnormal gammaglobulin in the serum. There are three major criteria in the diagnosis of multiple myeloma:

1. Plasmacytoma on tissue biopsy
2. Bone marrow plasmacytosis greater than 30% plasma cells
3. Monoclonal immunoglobulin spike on serum protein electrophoresis exceeding 3.5 g/dl for G peaks or 2.0 g/dl for A peaks or 1.0 g/24 hours of kappa or lamba light chain excretion on urine electrophoresis

Correct Answer: Serum protein electrophoresis

3736. (1361) Q9-1731:





Slide 1 **Slide 2**

A 55-year old man presents with a 4-month history of shoulder discomfort. The plain radiographs are shown in Slide 1 and a biopsy in Slide 2. Which of the following tests will probably be abnormal:

1) Serum alkaline phosphatase levels
3) Serum parathyroid hormone level
2) Urine hydroxyproline levels
5) Serum prostate specific antigen level
4) Serum hemoglobin and erythrocyte sedimentation rate

The plain radiograph of the shoulder shows lytic lesions in the scapular spine, distal clavicle, and the proximal third of the clavicle. There is an elliptical erosion in the proximal clavicle. These three lesions suggest a diagnosis of metastatic bone disease or multiple myeloma. The biopsy specimen shows plasma cells. The plasma cells have these characteristic features:

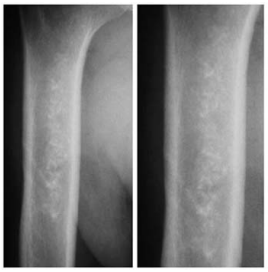
- Eccentrically placed nucleus
- Peripheral clumping of the nuclear chromatin
- A perinuclear halo

The diagnosis is multiple myeloma. Staging is important and is performed with a skeletal survey, bone marrow biopsy, hemoglobin level, and chemistry studies including kidney function and serum calcium determination.

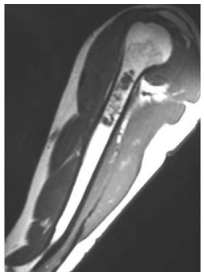
The serum hemoglobin and erythrocyte sedimentation rates will be abnormal in approximately two-thirds of patients.

Correct Answer: Serum hemoglobin and erythrocyte sedimentation rate

3737. (2419) Q9-2880:

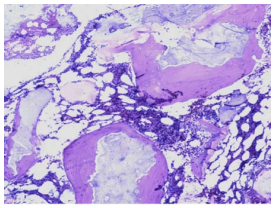


Slide 1

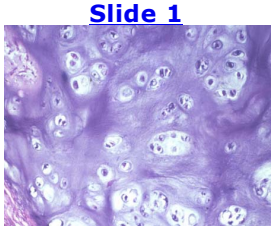


Slide 2

Slide 3



Slide 4



Slide 5

A 45-year-old man has pain with overhead activity and discomfort when he lies on his shoulder at night. Plain radiographs of his humerus are shown in Slide 1. T1- and T2-weighted coronal images are shown in Slide 2 and Slide 3, respectively. A low- and high-power biopsy specimen is shown in Slide 4 and Slide 5, respectively. The best form of treatment would be:

1) Internal fixation and external beam irradiation
3) Preoperative chemotherapy and wide resection
2) External beam irradiation
5) Wide resection alone
4) Observation

The plain radiographs of the humerus show an intramedullary lesion that is mineralized. Notice that the cortices are intact. The T1-weighted coronal magnetic resonance image (MRI) shows a well-defined, low- signal lesion and the T2-weighted image shows a well-defined, high-signal lesion. Both sequences show a lobular (small circle) pattern to the lesion. The plain radiograph and MRI scan are consistent with a cartilage lesion. The lack of cortical changes indicates a diagnosis of enchondroma.

The biopsy specimen on low power shows lobules of cartilage surrounded by enchondral bone formation. The cartilage is hypocellular, and the nuclei are consistently small and round.

The diagnosis of enchondroma can be made with plain radiographs alone or plain radiographs and MRI scans. Treatment is observation with new radiographs in 3 to 6 months.Correct Answer: Observation

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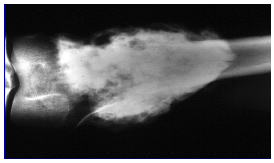
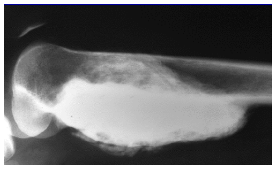
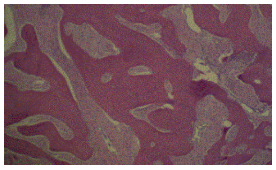
3738. (2420) Q9-2881:



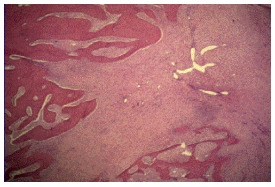
Slide 1



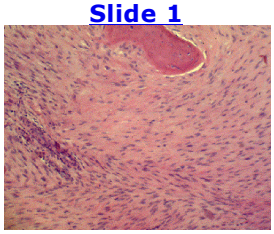
Slide 2



Slide 3



Slide 4



Slide 5

A 30-year-old woman has had a painless mass in the back of her knee for 6 months. She has a restricted range of motion. The plain radiographs are shown in Slide 1 and Slide 2. The biopsy specimen is shown in Slide 3, Slide 4, and Slide 5. The best treatment for this patient would be:

1) Observation
3) Wide resection and reconstruction
2) Preoperative chemotherapy followed by wide resection/reconstruction
5) Internal fixation followed by external beam irradiation
4) Preoperative chemotherapy and radiation followed by resection/reconstruction

Notice the heavily mineralized lesion on the surface of the bone. This is consistent with a parosteal osteosarcoma. There is a broad attachment to the bone and the tumor encircles the bone. The histologic section shows mature bone and a low-grade fibrous stroma (Grade 1 fibrosarcoma).

The diagnosis is parosteal osteosarcoma. Parosteal osteosarcomas are best treated by surgical resection without chemotherapy or radiation therapy.Correct Answer: Wide resection and reconstruction

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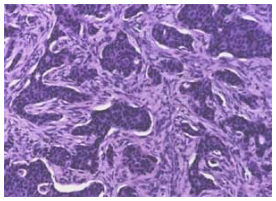
3739. (2421) Q9-2882:



Slide 1 **Slide 2** **Slide 3**

A 58-year-old woman has diffuse pelvic and right hip pain. She has pain at rest and when she ambulates. The plain radiograph and computed tomography scan are shown in Slide 1 and Slide 2, respectively. A biopsy specimen is shown in Slide 3. The most likely diagnosis is:

1) Lymphoma
3) Multiple myeloma
2) Metastatic bone disease
5) Malignant fibrous histiocytoma
4) Chondrosarcoma

The plain radiograph shows a sclerotic lesion in the intertrochanteric region, ilium, ischium, and sacrum. The lesions are densely sclerotic. The biopsy specimen shows epithelial cells in clusters forming glands. These cells have completely replaced the bone marrow.

This patient has metastatic breast carcinoma.Correct Answer: Metastatic bone disease

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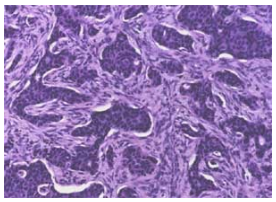
3740. (2422) Q9-2883:



Slide 1 **Slide 2** **Slide 3**

A 58-year-old woman has diffuse pelvic and right hip pain. She has pain at rest and when she ambulates. The plain radiograph and computed tomography scan are shown in Slide 1 and Slide 2, respectively. A biopsy specimen is shown in Slide 3. The most effective treatment would be:

1) Dynamic hip screw fixation of the femur and external beam irradiation
3) External beam irradiation
2) Intramedullary rod fixation of the femur and external beam irradiation
5) Resection of the proximal femur and custom replacement
4) Chemotherapy and external beam irradiation to painful sites

The plain radiograph shows a sclerotic lesion in the intertrochanteric region, ilium, ischium, and sacrum. The lesions are densely sclerotic. The biopsy specimen shows epithelial cells in clusters forming glands. These cells have completely replaced the bone marrow.

This patient has metastatic breast carcinoma.

The lesions in the proximal femur are completely sclerotic with no evidence of cortical bone destruction. The proximal femur is at low risk for fracture; therefore, surgery is not necessary. The best treatment is systemic chemotherapy and radiation to painful sites. Radiation alone is not adequate as the patient should be on systemic treatment (chemotherapy, hormonal therapy, or monoclonal antibody therapy).Correct Answer: Chemotherapy and external beam irradiation to painful sites

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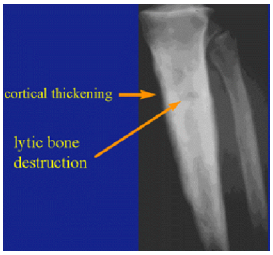
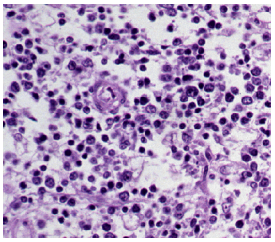
3741. (2423) Q9-2884:





Slide 1 **Slide 2**

A 60-year-old woman has had severe pain in her leg for the past 8 months. The plain radiograph is shown in Slide 1 , and a biopsy of the tibia in Slide 2. The most likely diagnosis is:

1) Metastatic bone disease
3) Chondrosarcoma
2) Malignant fibrous histiocytoma
5) Lymphoma
4) Myeloma

The plain radiograph shows a lesion with multiple areas of bone lysis and areas of sclerosis. There is also thickening of the anterior and posterior cortices. The biopsy specimen shows large and small blue cells. Notice that the cells do not match the description of metastatic bone disease, myeloma, malignant fibrous histiocytoma, or chondrosarcoma. This patient has a lymphoma.

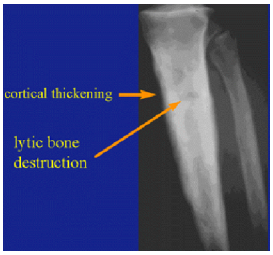
- Metastatic bone disease - epithelial cells forming glands in a fibrous background
- Multiple myeloma - sheets of plasma cells
- Malignant fibrous histiocytoma - storiform pattern of spindle cells and histiocytes
- Chondrosarcoma - cartilage forming tumor with atypical chondrocytes

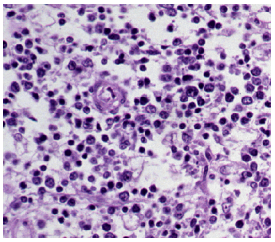
Lymphoma

- Uniform cells with large round nucleus and clumped chromatin
- Scant cytoplasm

Correct Answer: Lymphoma

3742. (2424) Q9-2885:





Slide 1 **Slide 2**

A 60-year-old woman has had severe pain in her leg for the past 8 months. The plain radiograph is shown in Slide 1, and a biopsy of the tibia in Slide 2. The most appropriate treatment is:

1) Curettage and bone grafting
3) External beam irradiation and chemotherapy
2) Resection and prosthetic reconstruction
5) Above the knee amputation
4) Diphosphonate therapy

The plain radiograph shows a lesion with multiple areas of bone lysis and areas of sclerosis. There is also thickening of the anterior and posterior cortices. The biopsy specimen shows large and small blue cells. Notice that the cells do not match the description of metastatic bone disease, myeloma, malignant fibrous histiocytoma, or chondrosarcoma. This patient has a lymphoma.

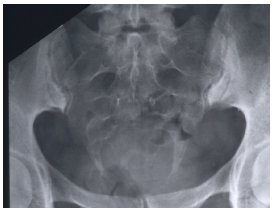
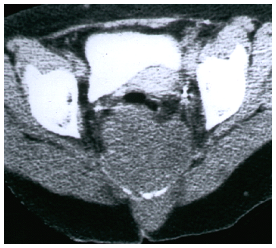
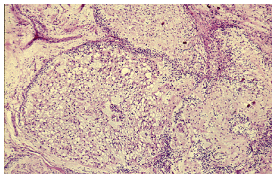
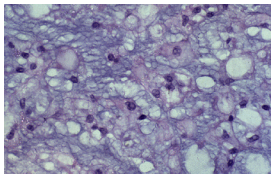
- Metastatic bone disease - epithelial cells forming glands in a fibrous background
- Multiple myeloma - sheets of plasma cells
- Malignant fibrous histiocytoma - storiform pattern of spindle cells and histiocytes
- Chondrosarcoma - cartilage forming tumor with atypical chondrocytes

Lymphoma

- Uniform cells with large round nucleus and clumped chromatin
- Scant cytoplasm

Correct Answer: External beam irradiation and chemotherapy

3743. (2425) Q9-2886:

Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 55-year-old man presented with a 12-month history of increasing low back pain. He experiences pain during the night and often has difficulty sitting. He has also noticed that in the last 9 months constipation has become an increasing problem. The plain radiographs and computerized tomography (CT) scan are shown (Slide 1 and Slide 2). Low- and high-power histologic sections are also presented (Slide 3 and Slide 4). The most appropriate treatment is:

1) Chemotherapy and radiation
3) Observation and protected weight bearing
2) External radiation
5) Wide resection
4) Chemotherapy and wide resection

The plain radiograph of the pelvis shows the sacrum and sacroiliac joints. The CT scan shows destruction of the sacrum with an anterior soft tissue mass. The low-power photomicrograph shows a lobular tumor. The high-power photomicrograph shows physaliferous cells in a myxoid background.

Both the CT scan and biopsy are consistent with a chordoma.

Chordoma is a low-grade malignant tumor that arises from notochordal cells. As a low-grade tumor, metastases occur late in the disease. Local failure is common following surgical resection. Progressive local disease accounts for the poor 10-year disease-free survival of only 25%.Correct Answer: Wide resection

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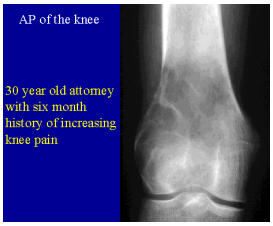
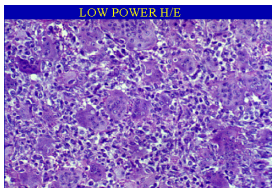
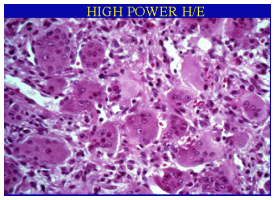
3744. (2426) Q9-2887:







Slide 1 **Slide 2** **Slide 3** **Slide 4**

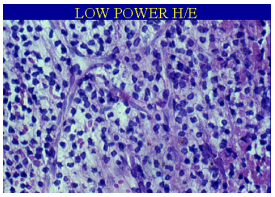
A 30-year-old attorney has a 6-month history of increasing knee pain. His pain occurs both with activity and at rest. He is otherwise healthy. Laboratory studies show a normal complete blood count, sedimentation rate, and chemistry values (including normal calcium and phosphorus levels). Anteroposterior and lateral radiographs are shown (Slide 1 and Slide 2). The low- and high-power hematoxylin and eosin sections are shown (Slide 3 and Slide 4). The most appropriate treatment is:

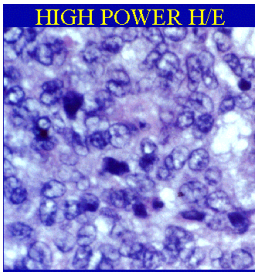
1) Observation
3) External beam irradiation
2) Curettage
5) Wide resection and reconstruction
4) Chemotherapy and external beam irradiation

The radiograph shows purely lytic bone destruction that fills the lateral metaphysis and extends to the articular surface. The lateral cortex is very thin and almost completely destroyed. The histologic sections show collection of giant cells and mononuclear cells. Notice that the giant cells are uniformly scattered throughout the histologic section on the low power, in contrast to chondroblastoma where the giant cells are scattered throughout the mononuclear cells and that the nuclei of the mononuclear cells are the same as the nuclei of the giant cells.

The diagnosis is giant cell tumor of bone. The treatment of giant cell tumor of bone is complete curettage of the tumor. Wide exteriorization (extensive removal of the cortex over the lesion), curettage with hand and power instruments, and chemical cauterization is necessary to reduce the chance of local recurrence. Cement augmentation is often used to fill the large cavity following curettage.Correct Answer: Curettage

3745. (2427) Q9-2888:





Slide 1 **Slide 2** **Slide 3**

A 25-year-old man has a 4-month history of severe thigh and knee pain. He has pain both at rest and at night. He has tenderness on palpation of the thigh. He has been febrile and has an elevated white blood cell count. The anteroposterior and lateral radiographs of the femur are shown (Slide1). The high- and lower-power histologic sections are also shown (Slide 2) and (Slide 3). The most appropriate treatment is:

1) Observation
3) Methyl prednisolone acetate injection
2) Debridement and intravenous antibiotics
5) Chemotherapy and external beam irradiation
4) Wide resection

The plain radiographs show permeative lytic lesion in the femur with periosteal reaction. The diagnostic considerations based upon the age of the patient and radiographic findings would be:

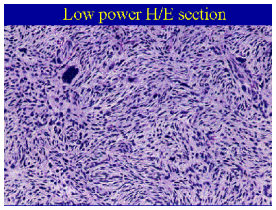
Benign	**Malignant**
Osteomyelitis	Ewing's tumor
Eosinophilic granuloma	Osteosarcoma
	Leukemia/lymphoma

The biopsy specimen shows a monotonous field of uniform blue cells. The biopsy is most consistent with Ewing's tumor.

Ewing's tumor is a high-grade malignancy with a propensity to metastasize to the lungs and bone marrow. The traditional treatment is multi-agent chemotherapy and external beam irradiation. Resection of the bone is used in selected patients in some centers.

*Remember that there is a consistent chromosomal translocation, 11-22, in patients with Ewing's tumor [t (11;22)].*Correct Answer: Chemotherapy and external beam irradiation

3746. (2428) Q9-2889:



Slide 1 **Slide 2**

A 55-year-old man presented with a 4-month history of severe knee pain. The plain anteroposterior radiograph of the knee is shown (Slide 1). He has pain both at rest and at night. A staging evaluation was performed to determine of this was a metastatic lesion. A chest radiograph, chest computed tomography (CT) scan, and an abdominal CT scan were all negative. Serum studies showed a normal complete blood cell count, differential, chemistry group, and serum electrophoresis. A biopsy was performed and is shown (Slide 2). The most appropriate treatment is:

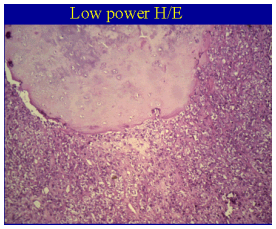
1) Observation
3) External beam irradiation
2) Internal fixation with external beam irradiation
5) Wide resection and chemotherapy
4) Chemotherapy and external beam irradiation

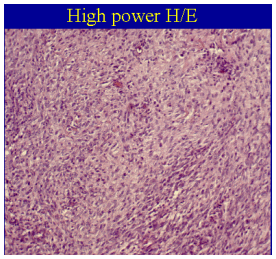
The radiographics show a destructive lesion with a mottled appearance: a mixture of bone destruction and bone formation.

The differentiated diagnosis of this destructive lesion is based on the radiographic features and the patients age. Differentiated diagnosis includes: metastatic bone disease, myeloma, lymphoma, chondrosarcoma, and malignant fibrous histiocytoma.

The biopsy specimen shows the characteristic features of malignant fibrous histiocytoma: a storiform pattern, histiocytes, and bizarre giant cells. The diagnosis is malignant fibrous histiocytoma. This is a high grade tumor and wide resection is necessary.Correct Answer: Wide resection and chemotherapy

3747. (2429) Q9-2890:





Slide 1 **Slide 2** **Slide 3**

A 60-year-old man presents with a 6-month history of increasing knee and distal thigh pain. He is otherwise healthy and has no history of prior malignancies. He has discomfort at night and at rest. The plain radiograph of the lesion is shown (Slide 1), and low and high power histologic sections from an open biopsy are shown (Slide 2 and Slide 3). The most appropriate treatment is:

1) Observation
3) Curettage and grafting
2) Core decompression
5) Wide resection and reconstruction
4) Curettage, internal fixation, and external beam irradiation

Dedifferentiated chondrosarcomas are high-grade cartilage tumors that are bimorphic (two distinct histologic components). Alongside the very low-grade cartilage tumor are areas of high-grade spindle cell sarcoma. The cartilage component is very low grade (grade Â½, grade 1, or grade 2), while the high-grade component is an anaplastic spindle cell sarcoma; either osteosarcoma, fibrosarcoma, or malignant fibrous histiocytoma. The radiographs also reflect the histologic bimorphic component; area typical for low-grade chondrosarcoma with superimposed aggressive area. The aggressive component is usually represented by an area of:

- Lytic bone destruction
- Cortical bone erosion or typically destruction
- Soft tissue mass

The treatment of dedifferentiated chondrosarcoma is wide resection by either local resection or amputation. The margins must include a cuff of normal tissue secondary to the high grade nature of the tumor. The prognosis is poor with pulmonary metastases in 60% to 80% of patients.

Correct Answer: Wide resection and reconstruction

3748. (2430) Q9-2891:

Which of the following serum tests is most useful in the diagnosis of Pagetâs disease:

1) Parathyroid hormone
3) Alkaline phosphatase
2) Calcium level
5) Lactic dehydrogenase
4) Phosphate level

Paget disease is a remodeling disease of bone. The osteoclast is the responsible cell. There is an increase in size, number, and activity. The treatment of Paget disease is aimed at the activity of the osteoclast. Diphosphonates are the mainstay of treatment.

The alkaline phosphatase level is elevated in 95% of patients. Collagen breakdown products can also be detected in the urine â hydroxy proline or N-telopeptide. Following treatment, there is a reduction in serum alkaline phosphate levels.Correct Answer: Alkaline phosphatase

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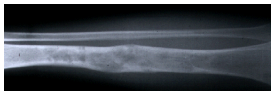
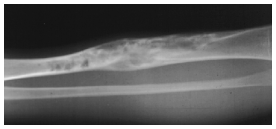
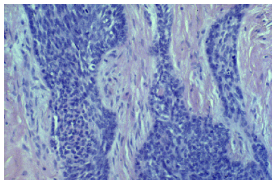
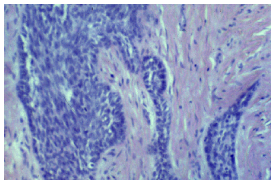
3749. (2431) Q9-2892:

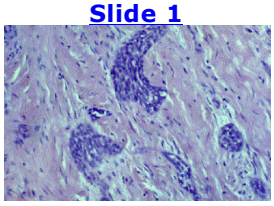








Slide 1 **Slide 2** **Slide 3** **Slide 4**



Slide 5

A 30-year-old man presents with an 18-month history of pain in his leg. The pain is over the mid-section of the tibia and occurs both at rest and activity. There no history of trauma or infections. The plain radiographs are shown (Slide 1 and Slide2) and a biopsy of the lesion is shown (Slide 3, Slide 4 and Slide 5). The most appropriate treatment is:

1) Debridement and intravenous antibiotics
3) Curettage, cortical bone grafting, and internal fixation
2) Observation
5) Wide resection and reconstruction
4) Preoperative chemotherapy and wide resection

Adamantinoma most commonly occurs in the tibia and has multiple areas of bone destruction. There is often intervening bone sclerosis between the areas of bone destruction. The biopsy specimens shows the typical features of adamantinoma: epithelial cells in fibrous stroma.

The treatment of adamantinoma is wide resection. This lesion is a low grade malignancy with late metastases. There is no role for chemotherapy or radiation in patients with localized disease.Correct Answer: Wide resection and reconstruction

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3750. (2542) Q9-3013:

Which of the following is the most common skeletal site of metastatic bone disease:

1) Proximal femur
3) Cervical spine
2) Pelvis
5) Ribs
4) Thoracolumbar spine

The most common sites of metastatic bone disease are the spine, pelvis, ribs, skull, and proximal limb girdles. The spine is the most common site and the thoracolumbar spine accounts for approximately 70% of spinal metastases.Correct Answer: Thoracolumbar spine

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3751. (2543) Q9-3014:

Which of the following is the correct histological description of metastatic bone disease:

1) Sheets of cells with an eccentric nucleus and a perinuclear clear zone
3) Clumps of round cells in a fibrous background
2) A mosaic pattern of broad irregular osteoid seams
5) Diffuse, noncleaved large cells permeating bone trabeculae
4) Storiform pattern of rounded and spindle cells

The characteristic histological appearance of metastatic bone disease is clumps of round cells in an organoid pattern in a fibrous stroma.

The other responses describe common conditions:

- Myeloma: Sheets of cells with an eccentric nucleus and a perinuclear clear zone
- Lymphoma: Diffuse, noncleaved large cells permeating bone trabeculae
- Malignant fibrous histiocytoma: Storiform pattern of rounded and spindle cells
- Pagetâs disease: Mosaic pattern of broad irregular osteoid seams

Correct Answer: Clumps of round cells in a fibrous background

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3752. (2544) Q9-3015:

Which of the following cells are responsible for the bone destruction in metastatic breast carcinoma:

1) Mast cells
3) Osteoclasts
2) Osteocytes
5) Histiocytes
4) Carcinoma cells

The bone resorption in both metastatic bone disease and multiple myeloma is caused by the osteoclasts. In both conditions, the tumor cells secrete a substance that recruits and activates the osteoclasts, which then resorb bone.Correct Answer: Osteoclasts

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3753. (2545) Q9-3016:

A woman with newly diagnosed breast cancer has multiple liver and pulmonary metastases and a lytic lesion in the midshaft of the left femur with 20% to 25% cortical bone destruction in a symmetric manner involving the femoral endosteal surfaces. She has no pain with weight bearing. Which of the following is the most accepted method to treat patients with femoral metastasis:

1) External beam irradiation alone
3) Intramedullary rod fixation and external beam irradiation
2) External beam irradiation and diphosphonate therapy
5) Curettage and plate fixation, external beam irradiation
4) Intramedullary rod fixation, diphosphonate therapy, and external beam irradiation

Patients with metastases to long bones may require prophylactic fixation. Plain radiographs are evaluated for the amount of cortical bone destruction and patients are asked if they have weight bearing pain. When cortical bone destruction exceeds 50% of the cortical diameter, the risk of fracture is high. When prominent weight bearing pain is present, the risk of fracture is also greater. This patient has a small amount of cortical bone destruction and no weight bearing pain. She can be managed nonoperatively.

External beam irradiation is used to halt the bone destruction by killing the tumor cells. Diphosphonate therapy is used to stop the osteoclastic bone resorption both in the femoral shaft and at other sites.

Correct Answer: External beam irradiation and diphosphonate therapy

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3754. (2546) Q9-3017:

Which of the following three variables concerning soft tissue sarcomas would portend the worst prognosis:

1) Low grade, superficial, and size less than 5 cm
3) High grade, superficial, and size less than 5 cm
2) Low grade, deep, and size less than 5 cm
5) Low grade, deep, and greater than 5 cm
4) High grade, deep, and greater than 5 cm

The variables that adversely effect prognosis in soft tissue sarcomas are:

- High grade
- Depth below the fascia
- Size greater than 5 cm

High-grade soft tissue sarcomas that are superficial (above the fascia) have a better prognosis than high-grade lesions below the fascia.

Correct Answer: High grade, deep, and greater than 5 cm

3755. (2547) Q9-3018:

Which of the following soft tissue lesions has the greater risk of local recurrence following excision:

1) Lipoma
3) Nodular fasciitis
2) Schwannoma
5) Angiolipoma
4) Extra-abdominal desmoid

Extra-abdominal desmoid tumors are prone to local recurrence with a rate as high as 50% in many series. External beam irradiation and low-dose chemotherapy have been used to halt progressive growth. The addition of external beam irradiation in selected cases improves the local control rate to approximately 75%.

Lipomas, schwannomas, nodular fasciitis, and angiolipoma have a low risk of local recurrence.

Correct Answer: Extra-abdominal desmoid

3756. (2548) Q9-3019:

Which of the following soft tissue tumors has the least risk of pulmonary metastases:

1) Epithelioid sarcoma
3) Pleomorphic liposarcoma
2) Synovial sarcoma
5) Clear cell sarcoma
4) Myxoid liposarcoma

Epithelioid sarcoma, synovial sarcoma, pleomorphic liposarcoma, and clear cell sarcoma are high-grade soft tissue sarcomas. The risk of pulmonary metastases in these soft tissue sarcomas is higher than 50%.

Myxoid liposarcoma is an intermediate grade liposarcoma with a metastatic rate of between 20% to 30%.

Correct Answer: Myxoid liposarcoma

3757. (2549) Q9-3021:

Which of the following genetic abnormalities may occur in polyostotic fibrous dysplasia:

1) Chromosomal translocation, 11-22
3) EXT1, EXT2 genes
2) Activating mutation, GNAS 1 gene
5) t(12;16) translocation
4) t(X;18)(p11.2;q11.2)

In polyostotic fibrous dysplasia, an activating mutation of the GNAS 1 gene has been found. There may also be over expression of the C-fos proto-oncogene.

The other responses refer to specific conditions:

- Ewingâs tumor: chromosomal translocation, 11-22
- Multiple exostoses: EXT1, EXT2 genes
- Synovial sarcoma: t(X;18)(p11.2;q11.2)
- Myxoid liposarcoma: t(12;16) translocation

Correct Answer: Activating mutation, GNAS 1 gene

3758. (2550) Q9-3022:

Which of the following describes the histological features of fibrous dysplasia:

1) Woven bone in a fibrous stroma with prominent osteoblastic rimming
3) Fascicles of atypical fibroblasts in a herringbone pattern
2) Spicules of woven bone in a cellular fibrous stroma
5) Storiform pattern of spindle cells with scattered small giant cells
4) Monotonous bland spindle cell proliferation with abundant collagen

The histological features of fibrous dysplasia are:

- Spicules of woven bone in cellular fibrous stroma: the woven bone may form patterns of Chinese letters or alphabet soup
- The woven bone lacks osteoblastic rimming
- Nodules of cartilage may be present

The other responses include:

- Osteofibrous dysplasia: Woven bone in a fibrous stroma with prominent osteoblastic rimming
- Desmoplastic fibroma: Monotonous bland spindle cell proliferation with abundant collagen
- Nonossifying fibroma: Storiform pattern of spindle cells with scattered small giant cells
- Fibrosarcoma: Fascicles of atypical fibroblasts in a herringbone pattern

Correct Answer: Spicules of woven bone in a cellular fibrous stroma

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3759. (2551) Q9-3023:

Which of the following describes the radiographic features of nonossifying fibroma of bone:

1) Metaphyseal, cortical bone destruction, ivory-like bone formation
3) Metaphyseal, eccentric, thinned cortex, sclerotic rim
2) Metaphyseal-epiphyseal, lytic, poorly marginalized
5) Diaphyseal, multiple lucent defects with intervening sclerosis
4) Epiphyseal, geographic lytic area, sclerotic rim

The characteristic radiographic appearance of nonossifying fibroma is:

- Metaphyseal
- Cortically based
- Lucent area
- Sclerotic rim
- Overlying cortex is thinned but intact

The other responses are for common bone lesions:

- Osteosarcoma: metaphyseal, cortical bone destruction, ivory like bone formation
- Giant cell tumor: metaphyseal-epiphyseal, lytic, poorly marginalized
- Chondroblastoma: epiphyseal, geographic lytic area, sclerotic rim
- Adamantinoma: multiple lucent defects with intervening sclerosis

Correct Answer: Metaphyseal, eccentric, thinned cortex, sclerotic rim

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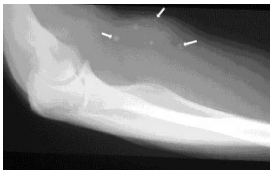
3760. (2578) Q9-3051:



Slide 1

A 15-year-old boy has a soft, painful mass over the proximal portion of his elbow. The lateral plain radiograph is shown (Slide). The most likely diagnosis:

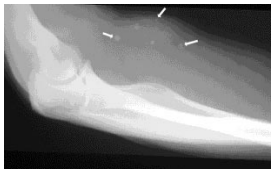
1) Heterotopic ossification
3) Hemangioma
2) Synovial sarcoma
5) Tumoral calcinosis
4) Calcific tendonitis

The lateral radiograph shows multiple perfectly round radiodensities scattered throughout the soft tissues. These radiodensities are phleboliths, and they are virtually diagnostic of a soft tissue hemangioma.

Surgically, hemangiomas are difficult to treat because they have a high incidence of local recurrence. Symptomatic treatment with anti-inflammatory medications and compression dressing is the first-line therapy. An interventional radiologist uses sclerosing therapy to treat patients who still have significant symptoms following symptomatic treatment. A sclerosing agent such as alcohol is used to close the numerous blood vessels.

Correct Answer: Hemangioma

3761. (2579) Q9-3052:



Slide 1

A 15-year-old boy has a soft, painful mass over the proximal portion of his elbow. The lateral plain radiograph is shown (Slide). Which of the following is the best form of treatment:

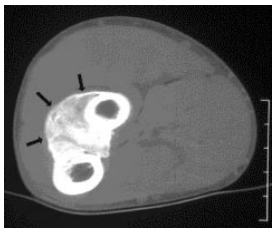
1) Angiography and sclerosing therapy
3) Chemotherapy
2) External beam irradiation
5) Chemotherapy and surgical resection
4) Surgical resection

The lateral radiograph shows multiple perfectly round radiodensities scattered throughout the soft tissues. These radiodensities are phleboliths, and they are virtually diagnostic of a soft tissue hemangioma.

Surgically, hemangiomas are difficult to treat because they have a high incidence of local recurrence. Symptomatic treatment with anti-inflammatory medications and compression dressing can be used. An interventional radiologist uses sclerosing therapy to treat patients who still have significant symptoms following symptomatic treatment. A sclerosing agent such as alcohol is used to close the numerous blood vessels.

Correct Answer: Angiography and sclerosing therapy

3762. (2580) Q9-3053:



Slide 1 **Slide 2**

A 35-year-old man has pain and limited pronation-supination of his forearm. His plain radiograph (Slide 1) and computed tomography scan (Slide 2) are shown. The most likely diagnosis is:

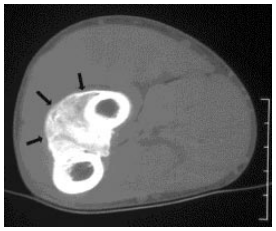
1) Sclerotic synovial sarcoma
3) Heterotopic ossification
2) Parosteal osteosarcoma
5) Parosteal osteoma
4) Parosteal lipoma

The plain radiograph shows heavy bone formation lateral to the proximal radius. This bone formation could be caused by a parosteal osteosarcoma, heterotopic ossification, or a parosteal osteoma.

The computed tomography scan shows the mature bone formation that is more mineralized at the periphery than in the center. The bone spans the radius and the ulna. The zonal pattern of greater mineralization at the periphery compared to the center is characteristic of heterotopic ossification.

Correct Answer: Heterotopic ossification

3763. (2581) Q9-3054:



Slide 1 **Slide 2**

A 35-year-old man has pain and limited pronation-supination of his forearm. His plain radiograph (Slide 1) and computed tomography scan (Slide 2) are shown. Appropriate treatment for this patient might include:

1) Preoperative chemotherapy and wide resection
3) External beam irradiation alone
2) Removal of the bridging bone and low-dose external beam irradiation
5) Above elbow amputation
4) Chemotherapy and radiation

The plain radiograph shows heavy bone formation lateral to the proximal radius. This bone formation could be caused by a parosteal osteosarcoma, heterotopic ossification, or a parosteal osteoma.

The computed tomography scan shows the mature bone formation that is more mineralized at the periphery than in the center. The bone spans the radius and the ulna. The zonal pattern of greater mineralization at the periphery compared to the center is characteristic of heterotopic ossification.

Heterotopic ossification treatment is either observation or removal to improve motion and function. Recurrence of the heterotopic bone may occur, and patients are often treated with low-dose external beam irradiation (usually one fraction of 800 cGy).

Correct Answer: Removal of the bridging bone and low-dose external beam irradiation

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3764. (2582) Q9-3055:

Slide 1

A 10-year-old boy has shoulder pain following a fall onto his shoulder. The plain radiograph is shown (Slide). Which of the following is the most likely diagnosis:

1) Osteosarcoma
3) Aneurysmal bone cyst
2) Ewingâs tumor
5) Fibrous dysplasia
4) Unicameral bone cyst

The plain radiograph shows a lytic lesion in the proximal humeral metaphysis. The medial and lateral cortices are thinned but intact (except for the minimally displaced fracture).

This radiograph is virtually diagnostic of unicameral bone cyst. The treatment is aspiration of the cyst and injection with methylprednisolone acetate.

Correct Answer: Unicameral bone cyst

3765. (2583) Q9-3056:

Slide 1

A 10-year-old boy has shoulder pain following a fall onto his shoulder. The plain radiograph is shown (Slide). Which of the following is the most accepted treatment:

1) Preoperative chemotherapy followed by wide resection
3) Wide resection and reconstruction
2) External beam irradiation
5) Aspiration and cortisone injection
4) Internal fixation and bone grafting

The plain radiograph shows a lytic lesion in the proximal humeral metaphysis. The medial and lateral cortices are thinned but intact (except for the minimally displaced fracture).

This radiograph is virtually diagnostic of unicameral bone cyst. The treatment is aspiration of the cyst and injection with methylprednisolone acetate.

Correct Answer: Aspiration and cortisone injection

3766. (2584) Q9-3057:

Slide 1

A 10-year-old boy has shoulder pain following a fall onto his shoulder. The plain radiograph is shown (Slide). Which of the following statements is true concerning the diagnosis:

1) Unicameral bone cysts are low-grade malignancies.
3) Unicameral bone cysts are aggressive benign neoplasms.
2) Unicameral bone cysts are high-grade malignancies.
5) Unicameral bone cysts are aggressive, benign non-neoplastic processes.
4) Unicameral bone cysts are self-limited, benign non-neoplastic processes.

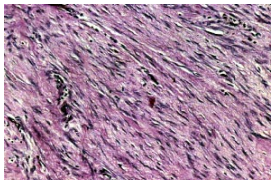
The plain radiograph shows a lytic lesion in the proximal humeral metaphysis. The medial and lateral cortices are thinned but intact (except for the minimally displaced fracture).

This radiograph is virtually diagnostic of unicameral bone cyst. The treatment is aspiration of the cyst and injection with methylprednisolone acetate.

Unicameral bone cysts are self-limited, benign non-neoplastic processes. They are not neoplasms.

Correct Answer: Unicameral bone cysts are self-limited, benign non-neoplastic processes.

3767. (2585) Q9-3058:



Slide 1

A 28-year-old woman has a hard mass over the extensor compartment of her forearm. The mass measures 6 cm and is located in the subcutaneous tissue. The mass is low signal on T1-weighted sequences and heterogeneous on T2-weighted sequences with low, moderate, and high areas. A needle biopsy specimen is shown (Slide). The most likely diagnosis is:

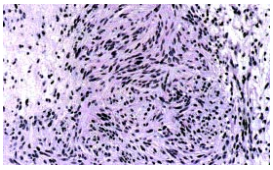
1) Fibrosarcoma
3) Synovial sarcoma
2) Malignant fibrous histiocytoma
5) Atypical lipoma
4) Extra-abdominal desmoid tumor

The imaging studies show a mass in the patient. The signal characteristics are nonspecific and do not aid the clinician in deciding whether the mass is benign or malignant.

The biopsy specimen shows a uniform population of fibroblasts and dense collagen deposition, which are characteristic of an extra-abdominal desmoid tumor.

Correct Answer: Extra-abdominal desmoid tumor

3768. (2586) Q9-3059:



Slide 1

A 50-year-old man has a 5-cm popliteal space mass that is low signal on T1-weighted sequences and high signal on T2-weighted sequences. The biopsy specimen is shown (Slide). The most likely diagnosis is:

1) Malignant fibrous histiocytoma
3) Schwannoma
2) Synovial sarcoma
5) Liposarcoma
4) Desmoid tumor

A large soft tissue mass that is located below the fascia should raise the suspicion of a sarcoma. All sarcomas have a common imaging pattern - low signal on T1-weighted sequences and high signal on T2-weighted sequences.

The biopsy specimen shows the features of a schwannoma with Antoni A and B areas. Note the cellular area and the loose myxoid area.

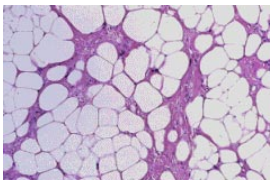
Antoni A - Compact spindle cells

- Twisted nuclei
- Indistinct cytoplasmic borders
- Short bundles or interlacing fascicles

Antoni B - Haphazard spindle cells in loose matrix, large vessels that may be filled with thrombus

Correct Answer: Schwannoma

3769. (2587) Q9-3060:



Slide 1

A 30-year-old woman has a 10-cm arm mass in located in the subcutaneous tissue. The mass is homogeneously high signal on T1-weighted images and moderate signal on T2-weighted images. A needle biopsy is shown (Slide). The most likely diagnosis is:

1) Liposarcoma
3) Epithelioid sarcoma
2) Malignant fibrous histiocytoma
5) Desmoid tumor
4) Lipoma

The mass is located in the subcutaneous tissue and could represent a benign process such as a lipoma or a sarcoma. Lesions that are high signal on T1-weighted images and moderate signal on T2-weighted sequences have the characteristics of fat. The biopsy shows mature fat cells with some intervening areas of fibrous tissue. This patient has a lipoma.Correct Answer: Lipoma

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3770. (2588) Q9-3061:

Which of the following soft tissue sarcomas is most prone to metastasizing to lymph nodes:

1) Myxoid liposarcoma
3) Clear cell sarcoma
2) Malignant fibrous histiocytoma
5) Pleomorphic liposarcoma
4) Fibrosarcoma

Several soft tissue sarcomas are prone to spread to lymph nodes:

- Synovial sarcoma
- Epithelioid sarcoma
- Rhabdomyosarcoma
- Clear cell sarcoma

Correct Answer: Clear cell sarcoma

3771. (2589) Q9-3062:

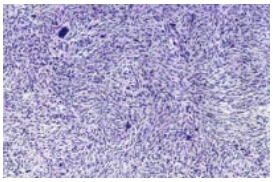
Synovial sarcomas may display genetic abnormalities. Which of the following is the most common genetic alteration in synovial sarcoma:

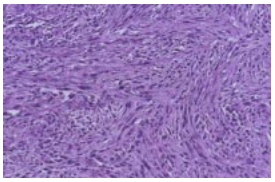
1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Translocation between chromosomes X and 18

Sarcoma	**Genetic Alteration**
Well-differentiated liposarcoma	Giant marker and ring chromosomes
Myxoid liposarcoma	Translocation between chromosomes 12 and 16
Ewing's sarcoma/ primitive neuroectodermal tumor	Translocation between chromosomes 11 and 22
Synovial sarcoma	Translocation between chromosomes X and 18
Myxoid chondrosarcoma	Translocation between chromosomes 9 and 22

Correct Answer: Translocation between chromosomes X and 18

3772. (2590) Q9-3063:





Slide 1 **Slide 2**

A 55-year-old man has a 10-cm thigh mass that is low signal on T1-weighted images and high signal on T2-weighted images. A needle biopsy is performed and shown in Slide 1 and Slide 2. The most likely diagnosis is:

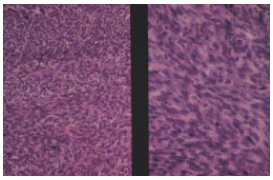
1) Soft tissue metastasis
3) Schwannoma
2) Myositis ossificans (heterotopic ossification)
5) Collagenous fibroma
4) Malignant fibrous histiocytoma

A large soft tissue mass that is located below the fascia should raise the suspicion of a sarcoma. All sarcomas have a common imaging pattern - low signal on T1-weighted sequences and high signal on T2-weighted sequences.

The biopsy shows the typical storiform pattern of malignant fibrous histiocytoma. Notice the spindle cells with different sizes and shapes of the nuclei (pleomorphism). There are also cells with round and vesicular nuclei.

Correct Answer: Malignant fibrous histiocytoma

3773. (2591) Q9-3064:



Slide 1

A 45-year-old man has a 5-cm hard mass over the extensor compartment of his forearm located below the fascia. A needle biopsy is shown (Slide). The most likely diagnosis is:

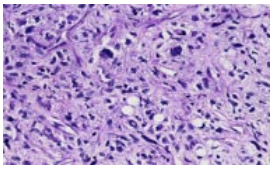
1) Fibrosarcoma
3) Schwannoma
2) Nodular fasciitis
5) Soft tissue Ewingâs tumor
4) Extra-abdominal desmoid tumor

A soft tissue mass that is located below the fascia should raise the suspicion of a sarcoma. All sarcomas have a common imaging pattern - low signal on T1-weighted sequences and high signal on T2-weighted sequences.

The biopsy shows spindle cells (fibroblasts) arranged in fascicles. Some of the nuclei are cut longitudinally, causing a spindle-shaped nuclei, whereas other nuclei are cut in cross section and appear round. The interlacing of the fascicles is termed a herringbone pattern. This patient has a fibrosarcoma.

Correct Answer: Fibrosarcoma

3774. (2592) Q9-3065:



Slide 1

A 60-year-old woman has a 15-cm soft tissue mass on her posterior thigh. The mass is low signal on T1-weighted images and high signal on T2-weighted images and is located below the fascia. A needle biopsy is shown (Slide). The most likely diagnosis is:

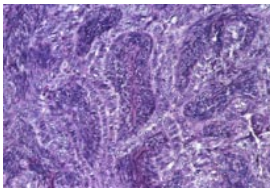
1) Lipoma
3) Liposarcoma
2) Atypical lipoma
5) Desmoid tumor
4) Schwannoma

A soft tissue mass that is located below the fascia should raise the suspicion of a sarcoma. All sarcomas have a common imaging pattern - low signal on T1-weighted sequences and high signal on T2-weighted sequences.

The needle biopsy shows a cellular lesion that has marked pleomorphism of the cells (different sizes and shapes of the nuclei). Some cells have intracytoplasmic fat globules; these cells are lipoblasts. **The presence of the lipoblasts and the pleomorphic spindles cells is compatible with a liposarcoma**. For examination purposes, one would not be able to distinguish this mass from a malignant fibrous histiocytoma.

Correct Answer: Liposarcoma

3775. (2593) Q9-3066:



Slide 1

A 30-year-old man has a 5-cm lesion in the deep tissues of his foot. The lesion is located below the fascia and is low signal on T1-weighted images and high signal on T2-weighted images. A needle biopsy is shown (Slide). The most likely diagnosis is:

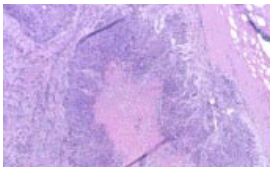
1) Lipoma
3) Nodular fasciitis
2) Heterotopic ossification
5) Schwannoma
4) Synovial sarcoma

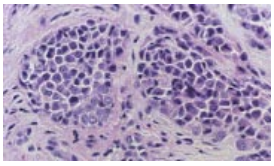
A soft tissue mass that is located below the fascia should raise the suspicion of a sarcoma. All sarcomas have a common imaging pattern - low signal on T1-weighted sequences and high signal on T2-weighted sequences.

The needle biopsy shows a lesion that has spindle cells and cells with round nuclei or epithelial-appearing cells. The epithelial cells either are arranged in clusters or might appear to be forming glands. This bimorphic pattern of spindle cells and epithelial cells is consistent with a synovial sarcoma.

Correct Answer: Synovial sarcoma

3776. (2594) Q9-3067:





Slide 1 **Slide 2**

A 23-year-old man has a 3-cm firm mass on the ulnar border of his hand. The mass is low signal on T1-weighted images and high signal on T2-weighted images. A biopsy is shown in Slide 1 and Slide 2. The most likely diagnosis is:

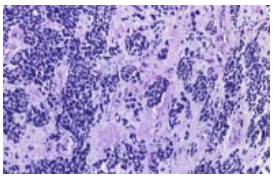
1) Nodular fasciitis
3) Foreign body granuloma
2) Schwannoma
5) Sebaceous cyst
4) Epithelioid sarcoma

A rare malignant tumor known as epithelioid sarcoma may occur in the upper extremity in young patients.

The biopsy shows a nodule on low power with an area of central necrosis. On high power, one sees rounded cells with eosinophilic cytoplasm. This is an epithelioid sarcoma.

Correct Answer: Epithelioid sarcoma

3777. (2595) Q9-3068:



Slide 1

A 10-year-old child has a 10-cm thigh mass that has grown rapidly over a 1-month period. The mass is deep to the fascia and is low signal on T1-weighted images and high signal on T2-weighted images. A biopsy is shown (Slide). The most likely diagnosis is:

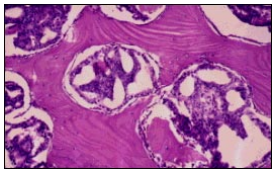
1) Nodular fasciitis
3) Rhabdomyosarcoma
2) Heterotopic ossification
5) Atypical lipoma
4) Schwannoma

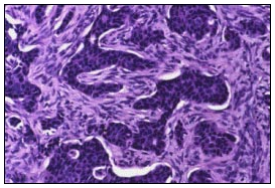
A rapidly growing mass in a child that is deep to the fascia is most likely a malignant tumor. Common sarcomas in young children include rhabdomyosarcoma, soft tissue Ewing's tumor, and primitive neuroectodermal tumor. All of these sarcomas look the same on magnetic resonance imaging - low signal on T1-weighted images and high signal on T2-weighted images.

These sarcomas also have a similar appearance on hematoxylin and eosin staining. There are clusters on small, round, blue cells. This patient has a rhabdomyosarcoma - other acceptable answers include soft tissue Ewing's tumor and primitive neuroectodermal tumor.

Correct Answer: Rhabdomyosarcoma

3778. (2708) Q9-3203:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. The most likely diagnosis is:

1) Metastatic bone disease
3) Lymphoma
2) Multiple myeloma
5) Chondrosarcoma
4) Malignant fibrous histiocytoma

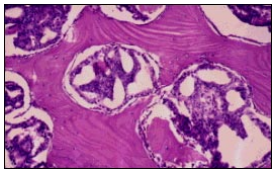
The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

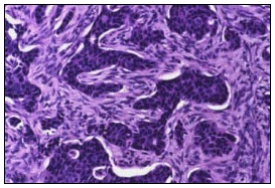
- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Â Â Â Chondrosarcoma
  Â Â Â Malignant fibrous histiocytoma

The biopsy specimen shows epithelial cells clumped together in an organoid pattern. **This patient has metastatic breast carcinoma.**

Correct Answer: Metastatic bone disease

3779. (2709) Q9-3204:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. Which of the following is the optimal treatment method:

1) Wide resection and prosthetic reconstruction followed by irradiation
3) Wide resection and prosthetic reconstruction
2) Internal fixation, external beam irradiation, and diphosphonate therapy
5) Observation
4) External beam irradiation and diphosphonate therapy

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

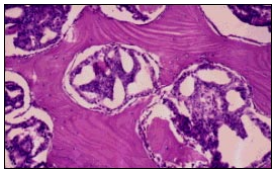
- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Chondrosarcoma
  Malignant fibrous histiocytoma

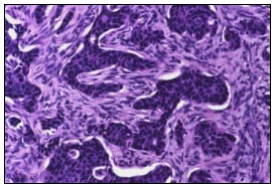
The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

There is between 25% and 50% cortical bone destruction. Note that the medial and anterior cortices are completely intact. **This patient can be treated with external beam irradiation and diphosphonate therapy with a low risk of fracture (about 10%)**. Although internal fixation is not necessary, if the patient does not want to risk having a fracture, then fixation can be performed with postoperative external beam irradiation and diphosphonate therapy.

Correct Answer: External beam irradiation and diphosphonate therapy

3780. (2710) Q9-3205:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. Which of the following is the correct disease process:

1) Metabolic bone disease
3) Benign neoplasm
2) Infection
5) Metastatic bone disease
4) Primary malignant mesenchymal tumor

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

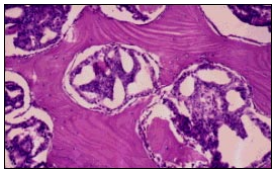
- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Â Â Â Chondrosarcoma
  Â Â Â Malignant fibrous histiocytoma

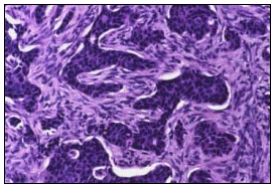
The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

Metastases can be confused with metabolic disorders such as Paget's disease or primary mesenchymal tumors such as chondrosarcoma.

Correct Answer: Metastatic bone disease

3781. (2711) Q9-3206:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. The final common denominator for the bone destruction in this patient is:

1) Parathyroid-related hormone (PTHrP)
3) Osteoprotegerin (OPG)
2) Receptor activator of nuclear activator ligand (RANKL)
5) Insulin-like growth factor 1 (IGF1)
4) Transforming growth factor beta (TGFB)

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Â Â Â Chondrosarcoma
  Â Â Â Malignant fibrous histiocytoma

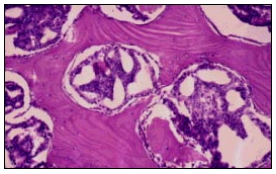
The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

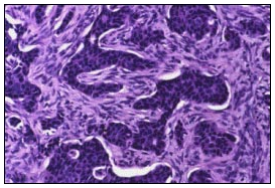
The breast carcinoma cells release PTHrP, which stimulates the osteoblasts to release RANKL, which activates the osteoclast progenitor cells. Remember that RANKL is the final common denominator for osteoclast activation. These cells then become osteoclasts and resorb bone. With the bone resorption, there is release of TGFB and IGF1 that stimulate the tumors cells to release more PTHrP, causing more bone destruction.

Remember that RANKL binds to the RANK receptor on the osteoclast progenitor cell and that OPG is a competitive decoy inhibitor to RANKL.

Correct Answer: Receptor activator of nuclear activator ligand (RANKL)

3782. (2712) Q9-3207:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. Which of the following is expressed by tumor cells:

1) Parathyroid-related hormone (PTHrP)
3) Osteoprotegerin (OPG)
2) Receptor activator of nuclear activator ligand (RANKL)
5) Insulin-like growth factor 1 (IGF1)
4) Transforming growth factor beta (TGFB)

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Chondrosarcoma
  Malignant fibrous histiocytoma

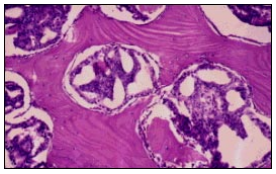
The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

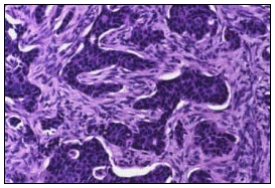
The breast carcinoma cells release PTHrP, which stimulates the osteoblasts to release RANKL, which activates the osteoclast progenitor cells. Remember that RANKL is the final common denominator for osteoclast activation. These cells then become osteoclasts and resorb bone. With the bone resorption, there is release of TGFB and IGF1 that stimulate the tumors cells to release more PTHrP, causing more bone destruction.

Remember that RANKL binds to the RANK receptor on the osteoclast progenitor cell and that OPG is a competitive decoy inhibitor to RANKL.

Correct Answer: Parathyroid-related hormone (PTHrP)

3783. (2713) Q9-3208:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. Which of the following is secreted by the osteoblasts after receiving a molecular signal from the tumor cells:

1) Parathyroid-related hormone (PTHrP)
3) Osteoprotegerin (OPG)
2) Receptor activator of nuclear activator ligand (RANKL)
5) Insulin-like growth factor 1 (IGF1)
4) Transforming growth factor beta (TGFB)

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Â Â Â Chondrosarcoma
  Â Â Â Malignant fibrous histiocytoma

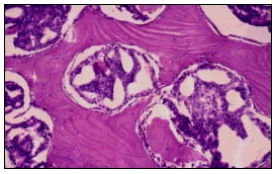
The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

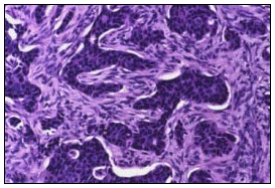
The breast carcinoma cells release PTHrP, which stimulates the osteoblasts to release RANKL, which activates the osteoclast progenitor cells. Remember that RANKL is the final common denominator for osteoclast activation. These cells then become osteoclasts and resorb bone. With the bone resorption, there is release of TGFB and IGF1 that stimulate the tumors cells to release more PTHrP, causing more bone destruction.

Remember that RANKL binds to the RANK receptor on the osteoclast progenitor cell and that OPG is a competitive decoy inhibitor to RANKL.

Correct Answer: Receptor activator of nuclear activator ligand (RANKL)

3784. (2714) Q9-3209:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4. Which of the following molecules is capable of decreasing osteoclastic activation:

1) Parathyroid-related hormone (PTHrP)
3) Osteoprotegerin (OPG)
2) Receptor activator of nuclear activator ligand (RANKL)
5) Insulin-like growth factor 1 (IGF1)
4) Transforming growth factor beta (TGFB)

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Chondrosarcoma
  Malignant fibrous histiocytoma

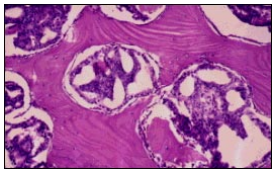
The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

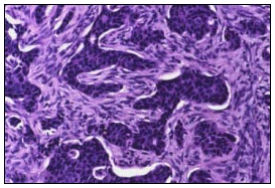
The breast carcinoma cells release PTHrP, which stimulates the osteoblasts to release RANKL, which activates the osteoclast progenitor cells. Remember that RANKL is the final common denominator for osteoclast activation. These cells then become osteoclasts and resorb bone. With the bone resorption, there is release of TGFB and IGF1 that stimulate the tumors cells to release more PTHrP, causing more bone destruction.

Remember that RANKL binds to the RANK receptor on the osteoclast progenitor cell and that OPG is a competitive decoy inhibitor to RANKL.

Correct Answer: Osteoprotegerin (OPG)

3785. (2715) Q9-3210:





Slide 1 **Slide 2** **Slide 3** **Slide 4**

A 65-year-old woman has had severe arm and shoulder pain for 4 months. Her plain radiographs are shown in Slide 1 and Slide 2. Sections from a needle biopsy are shown in Slide 3 and Slide 4.Which of the following is released during bone resorption:

1) Parathyroid-related hormone (PTHrP)
3) Osteoprotegerin (OPG)
2) Receptor activator of nuclear activator ligand (RANKL)
5) Smad protein
4) Transforming growth factor beta (TGFB)

The plain radiographs show a destructive lesion with a permeative pattern of bone destruction (multiple small lytic areas) and areas of bone formation - a mixed pattern of bone destruction and bone formation. The differential diagnosis based upon the radiographs alone in this age group (ages 40 to 80 years) includes:

- Metastatic bone disease
- Multiple myeloma
- Lymphoma
- Primary mesenchymal bone tumors:
  Chondrosarcoma
  Malignant fibrous histiocytoma

The biopsy specimen shows epithelial cells clumped together in an organoid pattern. This patient has metastatic breast carcinoma.

The breast carcinoma cells release PTHrP, which stimulates the osteoblasts to release RANKL, which activates the osteoclast progenitor cells. Remember that RANKL is the final common denominator for osteoclast activation. These cells then become osteoclasts and resorb bone. **With the bone resorption, there is release of TGFB and IGF1 that stimulate the tumors cells to release more PTHrP, causing more bone destruction.**

Remember that RANKL binds to the RANK receptor on the osteoclast progenitor cell and that OPG is a competitive decoy inhibitor to RANKL.

Correct Answer: Transforming growth factor beta (TGFB)

3786. (2753) Q9-3251:

Slide 1 **Slide 2**

A 14-year-old girl twisted her knee while playing lacrosse. Her anteroposterior (Slide 1) and lateral (Slide 2) radiographs are shown. The most likely cause of this condition is:

1) Benign bone neoplasm
3) Benign bone developmental condition
2) Malignant bone neoplasm
5) Stress fracture
4) Metabolic bone disease

The plain radiographs show an oval lucent lesion in the metaphysis of the proximal tibia. Note that the lesion is based on the metaphysic. This is the classic appearance of a small nonossifying fibroma. In this case, there is no sclerotic rim.

Nonossifying fibromas of bone are best considered as variants of normal growth. Nonossifying fibromas are rare in children younger than 2 years old and commonly occur at the sites of muscle attachment.

Correct Answer: Benign bone developmental condition

3787. (2754) Q9-3252:

Slide 1 **Slide 2**

A 14-year-old girl twisted her knee while playing lacrosse. Her anteroposterior (Slide 1) and lateral (Slide 2) radiographs are shown. The most likely diagnosis is:

1) Osteomyelitis
3) Bone island
2) Stress fracture
5) Enchondroma
4) Nonossifying fibroma

The plain radiographs show an oval lucent lesion in the metaphysis of the proximal tibia. Note that the lesion is based on the metaphysic. This is the classic appearance of a small nonossifying fibroma. In this case, there is no sclerotic rim.

Nonossifying fibromas of bone are best considered as variants of normal growth. Nonossifying fibromas are rare in children younger than 2 years old and commonly occur at the sites of muscle attachment.

Correct Answer: Nonossifying fibroma

3788. (2755) Q9-3253:

Slide 1 **Slide 2**

A 14-year-old girl twisted her knee while playing lacrosse. Her anteroposterior (Slide 1) and lateral (Slide 2) radiographs are shown. The most appropriate treatment is:

1) Curettage and bone grafting
3) En bloc resection and grafting
2) Aspiration and cortisone injection
5) Observation
4) Computed tomography-guided radiofrequency ablation

The plain radiographs show an oval lucent lesion in the metaphysis of the proximal tibia. Note that the lesion is based on the metaphysic. This is the classic appearance of a small nonossifying fibroma. In this case, there is no sclerotic rim.

Nonossifying fibromas of bone are best considered as variants of normal growth. Nonossifying fibromas are rare in children younger than 2 years old and commonly occur at the sites of muscle attachment.

Most nonossifying fibromas are asymptomatic and can be treated with observation. In this case, the nonossifying fibroma is so small that observation with a new radiograph in 3 months is all that is necessary. No activity restrictions are needed.

Correct Answer: Observation

3789. (2756) Q9-3254:

Slide 1

A 14-year-old boy developed pain following a collision while playing soccer. His radiograph is shown (Slide). The most likely cause of this condition is:

1) Benign bone neoplasm
3) Benign bone developmental condition
2) Malignant bone neoplasm
5) Stress fracture
4) Metabolic bone disease

The plain radiograph shows an oval lucent lesion in the metaphysis of the proximal tibia with a sclerotic rim. Note that the lesion is based on the metaphysic. This is the classic appearance of a small nonossifying fibroma. There is also a stress fracture at the superior lateral border (sclerotic band).

Nonossifying fibromas of bone are best considered as variants of normal growth. Nonossifying fibromas are rare in children younger than 2 years old and commonly occur at the sites of muscle attachment.

Correct Answer: Benign bone developmental condition

3790. (2757) Q9-3255:

Slide 1

A 14-year-old boy developed pain following a collision while plating soccer. His radiograph is shown (Slide). The most likely cause of this condition is:

1) Osteomyelitis
3) Bone island
2) Stress fracture
5) Enchondroma
4) Nonossifying fibroma

The plain radiograph shows an oval lucent lesion in the metaphysis of the proximal tibia with a sclerotic rim. Note that the lesion is based on the metaphysic. This is the classic appearance of a small nonossifying fibroma. There is also a stress fracture at the superior lateral border (sclerotic band).

Nonossifying fibromas of bone are best considered as variants of normal growth. Nonossifying fibromas are rare in children younger than 2 years old and commonly occur at the sites of muscle attachment.

Correct Answer: Nonossifying fibroma

3791. (2758) Q9-3256:

Slide 1 **Slide 2**

A 55-year-old man has a large soft tissue mass in his arm. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. The most likely diagnosis is:

1) Benign soft tissue neoplasm
3) Muscle hernia
2) Malignant soft tissue neoplasm
5) Arteriovenous malformation
4) Synovial cyst

The T1-weighted image shows a large high-signal mass in the patient's arm. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

The other lesions refer to common soft tissue processes:

- A malignant soft tissue neoplasm is low signal on T1-weighted images and high signal on T2-weighted images.
- A muscle hernia exactly follows muscle signal.
- A synovial cyst is uniformly dark signal on T1-weighted images and high signal on T2-weighted images.
- An arteriovenous malformation shows serpiginous channels that are low signal on T1-weighted images and high signal on T2-weighted images.

Correct Answer: Benign soft tissue neoplasm

3792. (2759) Q9-3257:

Slide 1 **Slide 2**

A 55-year-old man has a large soft tissue mass in his arm. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. The most likely diagnosis is:

1) Intramuscular lipoma
3) Malignant fibrous histiocytoma
2) Glenohumeral ganglion
5) Hematoma
4) Hemangioma

The T1-weighted image shows a large high-signal mass in the patient's arm. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

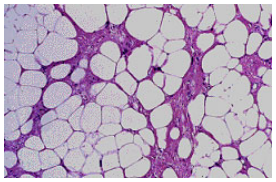
This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

The other lesions refer to common soft tissue processes:

- A malignant fibrous histiocytoma is low signal on T1-weighted images and high signal on T2-weighted images.
- A hematoma shows fluid signal and is heterogeneous, with a low signal on T1-weighted images and high signal on T2-weighted images.
- A glenohumeral ganglion is uniformly dark signal on T1-weighted images and high signal on T2-weighted images.
- An arteriovenous malformation shows serpiginous channels that are low on T1-weighted imaged and high signal on T2-weighted images.

Correct Answer: Intramuscular lipoma

3793. (2760) Q9-3258:



Slide 1 **Slide 2** **Slide 3**

A 55-year-old man has a large soft tissue mass in his arm. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. A biopsy is shown in Slide 3. Reasonable treatment options include:

1) Preoperative radiation followed by wide resection
3) Shoulder disarticulation
2) Wide resection followed by external beam irradiation
5) Preoperative chemotherapy and radiation followed by wide resection
4) Excision with a marginal margin

The T1-weighted image shows a large high-signal mass in the patientâs arm. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

Correct Answer: Excision with a marginal margin

3794. (2761) Q9-3259:

Slide 1 **Slide 2**

A 55-year-old man has a large soft tissue mass in his arm. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. The abnormal signal in the deltoid muscle is most likely:

1) Simple fluid
3) Malignant tumor cells
2) Complex fluid
5) Fibrous tissue
4) Fat

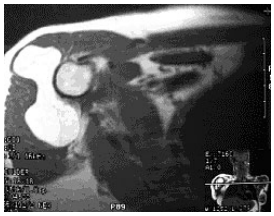
The T1-weighted image shows a large high-signal mass in the patient's arm. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

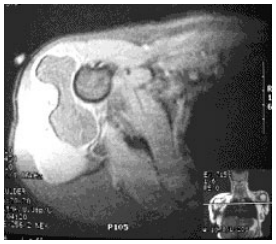
This process is benign fat cells.

This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

Correct Answer: Fat

3795. (2762) Q9-3260:





Slide 1 **Slide 2**

A 45-year-old woman has a large soft tissue mass in her deltoid muscle, which is located in the shoulder region. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. The most likely diagnosis is:

1) Benign soft tissue neoplasm
3) Muscle hernia
2) Malignant soft tissue neoplasm
5) Arteriovenous malformation
4) Synovial cyst

The T1-weighted image shows a large high-signal mass in the deltoid muscle. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

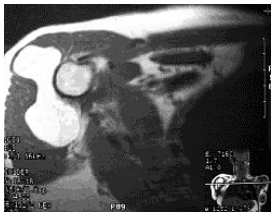
This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

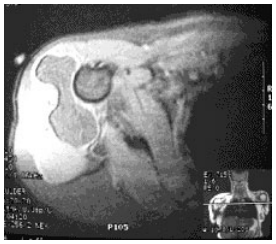
The other lesions refer to common soft tissue processes:

- A malignant soft tissue neoplasm is low signal on T1-weighted images and high signal on T2-weighted images.
- A muscle hernia exactly follows muscle signal.
- A synovial cyst is uniformly dark signal on T1-weighted images and high signal on T2-weighted images.
- An arteriovenous malformation shows serpiginous channels that are low signal on T1-weighted images and high signal on T2-weighted images.

Correct Answer: Benign soft tissue neoplasm

3796. (2763) Q9-3261:





Slide 1 **Slide 2**

A 45-year-old woman has a large soft tissue mass in her deltoid muscle, which is located in the shoulder region. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. The most likely diagnosis is:

1) Intramuscular lipoma
3) Malignant fibrous histiocytoma
2) Glenohumeral ganglion
5) Hematoma
4) Hemangioma

The T1-weighted image shows a large high-signal mass in the deltoid muscle. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

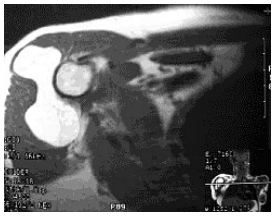
This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

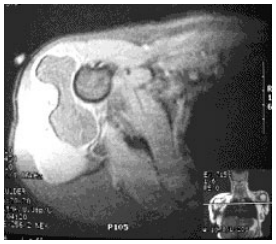
The other lesions refer to common soft tissue processes:

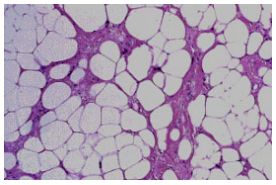
- A malignant fibrous histiocytoma is low signal on T1-weighted images and high signal on T2-weighted images.
- A hematoma shows fluid signal and is heterogeneous, with a low signal on T1-weighted images and high signal on T2-weighted images.
- A glenohumeral ganglion is uniformly dark signal on T1-weighted images and high signal on T2-weighted images.
- An arteriovenous malformation shows serpiginous channels that are low on T1-weighted imaged and high signal on T2-weighted images.

Correct Answer: Intramuscular lipoma

3797. (2764) Q9-3262:







Slide 1 **Slide 2** **Slide 3**

A 45-year-old woman has a large soft tissue mass in her deltoid muscle, which is located in the shoulder region. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. A biopsy is shown in Slide 3. Reasonable treatment options include:

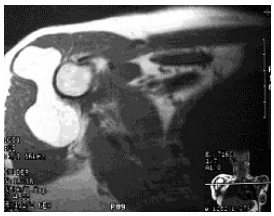
1) Preoperative radiation followed by wide resection
3) Shoulder disarticulation
2) Wide resection followed by external beam irradiation
5) Preoperative chemotherapy and radiation followed by wide resection
4) Excision with a marginal margin

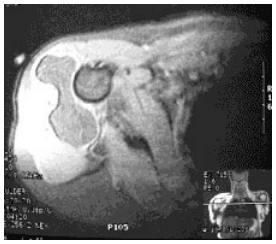
The T1-weighted image shows a large high-signal mass in the deltoid muscle. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

Correct Answer: Excision with a marginal margin

3798. (2765) Q9-3263:





Slide 1 **Slide 2**

A 45-year-old woman has a large soft tissue mass in her deltoid muscle, which is located in the shoulder region. The T1- and T2-weighted images are shown in Slide 1 and Slide 2. The abnormal signal in the deltoid muscle is most likely:

1) Simple fluid
3) Malignant tumor cells
2) Complex fluid
5) Fibrous tissue
4) Fat

The T1-weighted image shows a large high-signal mass in the deltoid muscle. The signal quality exactly matches the subcutaneous fat. Note on the T2-weighted image with fat suppression that the mass completely suppresses (or turns black or low signal).

This process is benign fat cells.

This patient has a lipoma or a benign soft tissue neoplasm. The patient can be treated with either observation or removal of the lipoma. The lipoma can be removed with a marginal or intralesional margin.

Correct Answer: Fat

3799. (2775) Q9-3273:

The classic triad of Hand-SchÃ¼ller-Christian disease is:

1) Pelvis lesion, enophthalmos, diabetes insipidus
3) Skull lesion, enophthalmos, acromegaly
2) Pelvis lesion, exophthalmos, acromegaly
5) Scapula lesion, diabetes insipidus, acromegaly
4) Skull lesion, exophthalmos, diabetes insipidus

Hand-SchÃ¼ller-Christian disease has a constellation of findings; the classic triad is a skull lesion, exophthalmos, and diabetes insipidus.

Hand-SchÃ¼ller-Christian disease used to be called histiocytosis X. It is now called Langerhans cell histiocytosis. Patients may have solitary bone involvement, multiple bone involvement, or bone and soft tissue involvement. The liver, spleen, and lymph nodes may be involved.

Correct Answer: Skull lesion, exophthalmos, diabetes insipidus

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3800. (2776) Q9-3274:

Which of the following is true concerning Langerhans cell histiocytosis (eosinophilic granuloma) of the spine:

1) Posterior element involvement is more common than anterior involvement.
3) Asymmetric vertebral collapse has a higher risk of long-term deformity.
2) Cervical spine involvement is rare.
5) Short-term bracing is effective treatment.
4) Neurological deficits are common.

Patients with Langerhans cell histiocytosis may develop spinal involvement.

One should remember these points from a recent study by Garg and colleagues.

- Cervical spine involvement is common.
- Anterior elements are involved in 95% of patients.
- The most common symptom in patients is dull low back pain.
- Neurological defects are uncommon.
- Symmetric vs. asymmetric collapse is not a prognostic factor for long-term deformity.
- Short-term bracing is effective.
- Approximately 10% of patients may need spinal deformity correction.

Correct Answer: Short-term bracing is effective treatment.

3801. (2777) Q9-3275:

Which of the following are classic findings in Langerhans cell histiocytosis of the spine:

1) Vertebral collapse, preservation of the disk space, absence of a soft tissue mass
3) Vertebral collapse, preservation of the disk space, anterior soft tissue mass
2) Vertebral collapse, disk space narrowing, absence of a soft tissue mass
5) Vertebral expansion, disk space narrowing, presence of a soft tissue mass
4) Vertebral expansion, disk space narrowing, absence of a soft tissue mass

Patients with Langerhans cell histiocytosis may develop spinal involvement.

One should remember these points from a recent study by Garg and colleagues.

- Cervical spine involvement is common.
- Multilevel disease is common especially in the cervical and lumbar regions.
- Anterior elements are involved in 95% of patients.
- Vertebral body collapse is common and may be symmetric or asymmetric.
- The most common symptom in patients is dull low back pain.
- Neurological defects are uncommon.
- Symmetric vs. asymmetric collapse is not a prognostic factor for long-term deformity.
- Short-term bracing is effective.
- Approximately 10% of patients may need spinal deformity correction.

Correct Answer: Vertebral collapse, preservation of the disk space, absence of a soft tissue mass

3802. (2778) Q9-3276:

Which of the following is true concerning Langerhans cell histiocytosis (eosinophilic granuloma) of the spine:

1) Dull back pain without neurological symptoms is the most common symptom.
3) Narrowing of disk space is common.
2) The most common site of involvement is the posterior element.
5) Multicentric spine involvement is rare.
4) Vertebral body reconstruction with correction of deformity is necessary with more than 50% collapse.

Patients with Langerhans cell histiocytosis may develop spinal involvement.

One should remember these points from a recent study by Garg and colleagues.

- Cervical spine involvement is common.
- Multilevel disease is common especially in the cervical and lumbar regions.
- Anterior elements are involved in 95% of patients.
- Vertebral body collapse is common and may be symmetric or asymmetric.
- The most common symptom in patients is dull low back pain.
- Neurological defects are uncommon.
- Symmetric vs. asymmetric collapse is not a prognostic factor for long-term deformity.
- Short-term bracing is effective.
- Approximately 10% of patients may need spinal deformity correction.

Correct Answer: Dull back pain without neurological symptoms is the most common symptom.

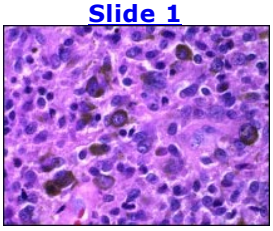
3803. (2783) Q9-3281:

Slide 1

Slide 2

Slide 3

Slide 4



Slide 5

A 35-year-old man has recurrent knee joint effusions, pain, and limited range of motion. A plain radiograph is shown in Slide 1, a T1-weighted coronal and sagittal sequence magnetic resonance image (MRI) in Slide 2 and Slide 3, and an axial T2-weighted image in Slide 4. A biopsy of the synovium is shown in Slide 5. The most likely diagnosis is:

1) Tuberculosis
3) Pigmented villonodular synovitis
2) Coccidiomycosis
5) Rheumatoid arthritis
4) Synovial chondromatosis

The plain radiograph shows erosion at the margin of the joint. The MRI scans show proliferation of the synovium.

The biopsy shows a mononuclear cell infiltrate. The cells are round to oval with pink cytoplasm. Hemosiderin-laden macrophages are also present.

This patient has pigmented villonodular synovitis. The treatment is synovectomy, which can be performed either arthroscopically or open. Patients with recurrent lesions or extensive disease are also offered external beam irradiation.

Correct Answer: Pigmented villonodular synovitis

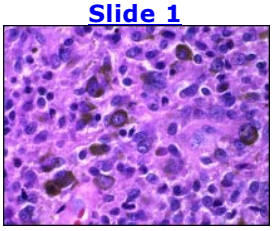
3804. (2784) Q9-3282:

Slide 1

Slide 2

Slide 3

Slide 4



Slide 5

A 35-year-old man has recurrent knee joint effusions, pain, and limited range of motion. A plain radiograph is shown in Slide 1, a T1-weighted coronal and sagittal sequence magnetic resonance image (MRI) in Slide 2 and Slide 3, and an axial T2-weighted image in Slide 4. A biopsy of the synovium is shown in Slide 5. The most appropriate treatment for this patient is:

1) Debridement and antibiotics
3) Observation
2) Rheumatic medications
5) Triple antibiotic therapy alone
4) Synovectomy

The plain radiograph shows erosion at the margin of the joint. The MRI scans show proliferation of the synovium.

The biopsy shows a mononuclear cell infiltrate. The cells are round to oval with pink cytoplasm. Hemosiderin-laden macrophages are also present.

This patient has pigmented villonodular synovitis. The treatment is synovectomy, which can be performed either arthroscopically or open. Patients with recurrent lesions or extensive disease are also offered external beam irradiation.

Correct Answer: Synovectomy

3805. (2785) Q9-3283:

Which of the following is the most common location of synovial chondromatosis:

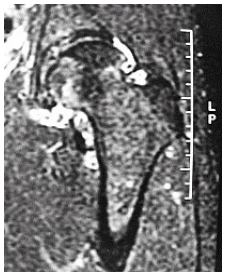
1) Hip
3) Shoulder
2) Knee
5) Ankle
4) Elbow

Synovial chondromatosis results when metaplasia of the subsynovial fibroblasts produces nodules of cartilage in the synovial membrane.

The most common location is the knee. The process may also occur in the hip, shoulder, and elbow.

Correct Answer: Knee

3806. (2786) Q9-3284:



Slide 1 **Slide 2** **Slide 3**

A 22-year-old man has intermittent aching pain in his left hip. His plain radiograph is shown in Slide 1 and the T1- and T2-weighted coronal magnetic resonance image (MRI) scans are shown in Slide 2 and Slide 3. The most likely diagnosis is:

1) Pigmented villonodular synovitis
3) Synovial chondromatosis
2) Rheumatoid arthritis
5) Heterotopic ossification
4) Tumoral calcinosis

Synovial chondromatosis results when metaplasia of the subsynovial fibroblasts produces nodules of cartilage in the synovial membrane.

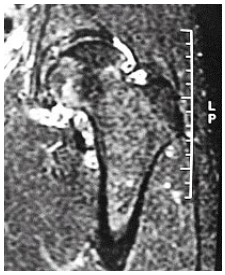
The most common location is the knee. The process may also occur in the hip, shoulder, and elbow.

Numerous small and large round, mineralized loose bodies are present in the plain radiograph. The MRI scan shows a joint effusion (high signal on T2-weighted images) and low signal masses. The T1-weighted images also show the numerous small low-signal masses.

This patient has synovial chondromatosis.

Correct Answer: Synovial chondromatosis

3807. (2787) Q9-3285:



Slide 1 **Slide 2** **Slide 3**

A 22-year-old man has intermittent aching pain in his left hip. His plain radiograph is shown in Slide 1 and the T1- and T2-weighted coronal magnetic resonance image (MRI) scans are shown in Slide 2 and Slide 3. Which of the following is the most beneficial treatment:

1) Protected weight bearing with crutches
3) Synovectomy
2) Removal of a parathyroid adenoma
5) Chemotherapy
4) External beam irradiation

This patient has synovial chondromatosis. Treatment for patients with this condition includes synovectomy with removal of as many of the loose bodies as possible.Correct Answer: Synovectomy

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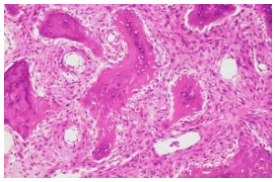
3808. (2809) Q9-3310:



Slide 1 **Slide 2**

A 12-year-old girl has occasional thigh pain. Her plain radiographs are shown in Slide 1 and a biopsy specimen in Slide 2. The most likely diagnosis is:

1) Aneursymal bone cyst
3) Osteosarcoma
2) Osteoblastoma
5) Osteofibrous dysplasia
4) Fibrous dysplasia

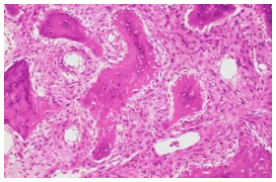
The plain radiographs show a lesion in the medullary cavity. Symmetric expansion of the bone is present. The cortices have been remodeled, but they are intact. The lesion has a mineralization pattern that is consistent with the ground glass appearance of fibrous dysplasia.

The biopsy specimen shows fragments of woven bone in a highly cellular fibrous stroma.

This child has fibrous dysplasia. One should remember that the genetic abnormality in fibrous dysplasia is caused by a mutation that affects the alpha subunit of the cell membrane-bound G protein (Gs alpha mutation).

Correct Answer: Fibrous dysplasia

3809. (2810) Q9-3311:



Slide 1 **Slide 2**

A 12-year-old girl has occasional thigh pain. Her plain radiographs are shown in Slide 1 and a biopsy specimen in Slide 2. Which of the following is the most likely genetic defect:

1) FGF receptor 3
3) Gs alpha mutation
2) EXT1, EXT2 genes
5) Translocation between chromosomes X and 18
4) COMP, type IX collagen, (COL9A2)

The plain radiographs show a lesion in the medullary cavity. Symmetric expansion of the bone is present. The cortices have been remodeled, but they are intact. The lesion has a mineralization pattern that is consistent with the ground glass appearance of fibrous dysplasia.

The biopsy specimen shows fragments of woven bone in a highly cellular fibrous stroma.

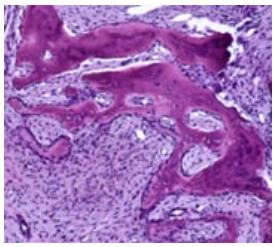
This child has fibrous dysplasia. One should remember that the genetic abnormality in fibrous dysplasia is caused by a mutation that affects the alpha subunit of the cell membrane-bound G protein (Gs alpha mutation).

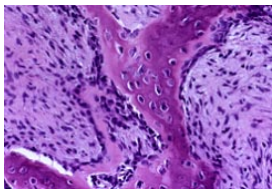
The other answers refer to specific entities:

- FGF receptor 3 - achondroplasia
- EXT1, EXT2 - multiple exostoses
- COMP, type IX collagen, (COL9A2) - multiple epiphyseal dysplasia
- Translocation between chromosomes X and 18 - synovial sarcoma

Correct Answer: Gs alpha mutation

3810. (2949) Q9-3452:





Slide 1 **Slide 2** **Slide 3**

A 10-year-old child has a mass over the anterior aspect of the tibia. A plain radiograph is shown in Slide 1 and a biopsy specimen in Slide 2 and Slide 3. The most likely diagnosis is:

1) Osteomyelitis
3) Osteofibrous dysplasia
2) Lymphoma
5) Adamantinoma
4) Fibrous dysplasia

The lateral radiograph of the tibia shows a large anterior cortex lucency. Notice that there is expansion of the anterior cortex and a gentle bow to the tibia, which is diagnostic for osteofibrous dysplasia. The biopsy specimen shows spicules of woven bone that are lined by osteoblasts. This is also diagnostic of osteofibrous dysplasia. Patients are generally treated with observation.Correct Answer: Osteofibrous dysplasia

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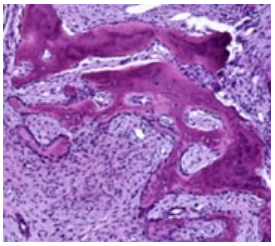
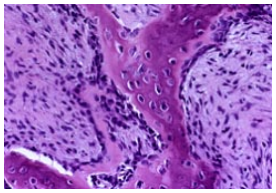
3811. (2950) Q9-3453:





Slide 1 **Slide 2** **Slide 3**

A 10-year-old child has a mass over the anterior aspect of the tibia. A plain radiograph is shown in Slide 1 and a biopsy specimen in Slide 2 and Slide 3. Which of the following would be the most appropriate treatment:

1) Debridement and antibiotic therapy
3) Chemotherapy and external beam irradiation
2) Preoperative chemotherapy followed by resection/reconstruction
5) Observation
4) External beam irradiation alone

The lateral radiograph of the tibia shows a large anterior cortex lucency. Notice that there is expansion of the anterior cortex and a gentle bow to the tibia, which is diagnostic for osteofibrous dysplasia. The biopsy specimen shows spicules of woven bone that are lined by osteoblasts. This is also diagnostic of osteofibrous dysplasia. Patients are generally treated with observation.Correct Answer: Observation

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3812. (2977) Q9-3483:

Malignant fibrous histiocytoma of bone:

1) Can be confused for fibrosarcoma of bone
3) Are usually low grade
2) Usually produces a significant osseous response
5) Rarely metastasizes
4) Are most commonly seen in the first 2 decades of life similar to Ewingâs sarcoma

Malignant fibrous histiocytoma of bone is a lytic tumor of bone, which is often high grade. The peak age of patients is 50 years of age, and metastasis occurs in approximately 50% of patients.Correct Answer: Can be confused for fibrosarcoma of bone

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3813. (2978) Q9-3484:

Chondromyxoid fibroma:

1) Frequently dedifferentiates into a malignant tumor if untreated
3) May cross the physis to involve the epiphysis
2) Rarely involves the physis
5) Often presents by fracture
4) Has a microscopic picture in which the chondral element predominates

Chondromyxoid fibroma has once been reported to dedifferentiate to chondrosarcoma. The tumor commonly abuts the physis, and is microscopically predominated by the myxoid element. Chondromyxoid fibroma rarely presents with a fracture.Correct Answer: May cross the physis to involve the epiphysis

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3814. (2995) Q9-3501:

Which of the following is the most important prognostic factor in a patient with a soft tissue sarcoma:

1) Location (superficial or deep)
3) Grade
2) Size
5) Gender
4) Age

The most important prognostic factor in patients with soft tissue sarcomas is the stage of the tumor. Staging takes into account the presence of metastases, grade, size, and depth.

The following factors are listed in descending order of impact on survival:

- Presence of metastases
- Grade
- Size
- Depth

The risk of pulmonary metastases is much higher in patients with high-grade tumors compared to low-grade tumors. Patients with soft tissue sarcomas that are located above the fascia have a better prognosis than those located below the fascia.

Correct Answer: Grade

3815. (2996) Q9-3502:

Which of the following is the most important prognostic factor in a patient with a soft tissue sarcoma:

1) Grade
3) Depth
2) Size
5) Gender
4) Presence of metastases

The most important prognostic factor in patients with soft tissue sarcomas is the stage of the tumor. Staging takes into account the presence of metastases, grade, size, and depth.

The following factors are listed in descending order of impact on survival:

- Presence of metastases
- Grade
- Size
- Depth

The risk of pulmonary metastases is much higher in patients with high-grade tumors compared to low-grade tumors. Patients with soft tissue sarcomas that are located above the fascia have a better prognosis than those located below the fascia.

Correct Answer: Presence of metastases

3816. (2997) Q9-3503:

Which of the following is the most important factor in a patient with a soft tissue sarcoma:

1) Depth
3) Size
2) Gender
5) Encapsulation
4) Age

The most important prognostic factor in patients with soft tissue sarcomas is the stage of the tumor. Staging takes into account the presence of metastases, grade, size, and depth.

The following factors are listed in descending order of impact on survival:

- Presence of metastases
- Grade
- Size
- Depth

The risk of pulmonary metastases is much higher in patients with high-grade tumors compared to low-grade tumors. Patients with soft tissue sarcomas that are located above the fascia have a better prognosis than those located below the fascia.

Correct Answer: Size

3817. (2998) Q9-3504:

Lymph node metastases are common in which of the following soft tissue tumors:

1) Extra-abdominal desmoid tumor
3) Malignant fibrous histiocytoma
2) Nodular fasciitis
5) Epitheloid sarcoma
4) Liposarcoma

Lymph node metastases may occur in the following soft tissue sarcomas:

- Lymph nodes (these lesions can have regional metastases):
    - Synovial sarcoma
    - Epithelioid sarcoma
    - Rhabdomyosarcoma
    - Clear cell Sarcoma

Epitheloid sarcoma is prone to metastasize to regional lymph nodes and to the skin and subcutaneous tissue.

Correct Answer: Epitheloid sarcoma

3818. (2999) Q9-3505:

Lymph node metastases are common in which of the following soft tissue sarcomas:

1) Malignant fibrous histiocytoma
3) Liposarcoma
2) Fibrosarcoma
5) Hemangiopericytoma
4) Synovial sarcoma

Lymph node metastases may occur in the following soft tissue sarcomas:

- Lymph nodes (these lesions can have regional metastases):
    - Synovial sarcoma
    - Epithelioid sarcoma
    - Rhabdomyosarcoma
    - Clear cell Sarcoma

Epitheloid sarcoma is prone to metastasize to regional lymph nodes and to the skin and subcutaneous tissue.

Correct Answer: Synovial sarcoma

3819. (3000) Q9-3506:

Soft tissue Ewing's sarcoma has which of the following genetic abnormalities:

1) Giant and marker ring chromosomes
3) Translocation between 11 and 22
2) Translocation between chromosomes 12 and 16
5) Translocation between 9 and 22
4) Translocation between X and 18

Several soft tissue sarcomas have well-recognized genetic abnormalities:

Well-differentiated liposarcoma	giant marker and ring chromosomes
Myxoid liposarcoma	translocation between 12 and 16
Ewing's/primitive neuroectodermal tumors	translocation between 11 and 22
Synovial sarcoma	translocation between X and 18
Myxoid chondrosarcoma	translocation between 9 and 22

Correct Answer: Translocation between 11 and 22

3820. (3001) Q9-3507:

Synovial sarcoma has which of the following chromosomal alterations:

1) Giant marker and ring chromosomes
3) Translocation between chromosomes 11 and 22
2) Translocation between chromosomes 12 and 16
5) Translocation between chromosomes 9 and 22
4) Translocation between chromosomes X and 18

Several soft tissue sarcomas have well-recognized genetic abnormalities:

Well-differentiated liposarcoma	giant marker and ring chromosomes
Myxoid liposarcoma	translocation between 12 and 16
Ewing's/primitive neuroectodermal tumors	translocation between 11 and 22
Synovial sarcoma	translocation between X and 18
Myxoid chondrosarcoma	translocation between 9 and 22

Correct Answer: Translocation between chromosomes X and 18

3821. (3002) Q9-3508:

Which of the following tumors commonly occurs in the hand:

1) Extra-abdominal desmoid tumor
3) Myxoid chondrosarcomas
2) Liposarcoma
5) Epitheloid sarcoma
4) Fibrosarcoma

Epitheloid sarcoma has a propensity to occur in the hand and upper extremity. This particular tumor is also prone to lymph node and skin/subcutaneous metastases.

Common locations include:

A. Location: Upper and lower extremities - 60%
    1. Thigh is most common location
    2. Specific tumors and site predilection
        a. Epitheloid sarcoma - most common soft tissue sarcoma of the upper extremity
        b. Synovial sarcoma -most common soft tissue sarcoma of the foot and ankle

Correct Answer: Epitheloid sarcoma

3822. (3050) Q9-3557:

In determining prognosis of a patient with a bone sarcoma, which of the following is the most important variable:

1) Grade of the tumor
3) Stage
2) Location
5) Age of the patient
4) Size

The factors that affect prognosis are often reflected in staging systems:

- Presence of metastases
- Grade of the tumor
- Size of the tumor

Remember that stage trumps all other factors. When stage is not an answer, the prognostic factors are:

- Presence of metastases
- Grade of the tumor
- Size of the tumor
    - For bone tumors in the AJCC system, > 8 cm is worse
- Site of the tumor
    - Spine and pelvic tumors generally have a worse prognosis

Important points to remember:

- Osteosarcoma
    - Response to chemotherapy is one of the most important prognostic factors
        - 99% necrosis is best, 90% to 99% is less favorable, <90% is a poor prognostic sign
    - Retinoblastoma gene (Rb1) is an association
    - Some studies have shown a poorer prognosis with elevated serum alkaline phosphatase or lactate dehydrogenase (AP, LDH)- this is controversial

Correct Answer: Stage

3823. (3051) Q9-3558:

Which of the following is the most important prognostic factor in a patient with osteosarcoma:

1) Size
3) Presence of metastases
2) Location
5) Grade
4) Age

The factors that affect prognosis are often reflected in staging systems:

- Presence of metastases
- Grade of the tumor
- Size of the tumor

Remember that stage trumps all other factors. When stage is not an answer, the prognostic factors are:

- Presence of metastases
- Grade of the tumor
- Size of the tumor
    - For bone tumors in the AJCC system, > 8 cm is worse
- Site of the tumor
    - Spine and pelvic tumors generally have a worse prognosis

Important points to remember:

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    - Retinoblastoma gene (Rb1) is an association
    - Some studies have shown a poorer prognosis with elevated serum alkaline phosphatase or lactate dehydrogenase (AP, LDH) - this is controversial

Correct Answer: Presence of metastases

3824. (3052) Q9-3559:

A 13-year-old boy has a destructive lesion in the distal femur. A magnetic resonance imaging scan shows cortical destruction and a moderate-sized soft tissue mass (5.5 cm). Needle biopsy shows a high-grade sarcoma. Which of the following studies should be performed to determine the stage of the tumor:

1) Bone marrow biopsy, computed tomography (CT) chest, and technetium bone scan
3) CT chest and technetium bone scan
2) CT chest and abdomen and technetium bone scan
5) Skeletal survey and CT chest and abdomen
4) Skeletal survey, CT chest, and positron emission tomography scan

The factors that affect prognosis are often reflected in staging systems:

- Presence of metastases
- Grade of the tumor
- Size of the tumor

Remember that stage trumps all other factors. When stage is not an answer, the prognostic factors are:

- Presence of metastases
- Grade of the tumor
- Size of the tumor
    - For bone tumors in the AJCC system, > 8 cm is worse
- Site of the tumor
    - Spine and pelvic tumors generally have a worse prognosis

Important points to remember:

- Osteosarcoma
    - Response to chemotherapy is one of the most important prognostic factors
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    - Retinoblastoma gene (Rb1) is an association
    - Some studies have shown a poorer prognosis with elevated serum alkaline phosphatase or lactate dehydrogenase (AP, LDH)- this is controversial

Correct Answer: CT chest and technetium bone scan

3825. (3053) Q9-3560:

A 13-year-old boy has a destructive lesion of the distal femur. Magnetic resonance images (MRIs) show a large soft tissue mass, and a needle biopsy shows a Ewing's sarcoma. Which of the following studies should be performed to complete the staging survey:

1) Technetium bone scan and computed tomography (CT) chest
3) Bone marrow biopsy, CT chest, and technetium bone scan
2) Technetium bone scan and CT chest and abdomen
5) CT chest and abdomen and skeletal survey
4) Skeletal survey, CT chest and abdomen, and bone marrow biopsy

Staging of most malignant bone tumors:

- Plain radiographs and cross-sectional imaging (MRI and/or CT)
- Technetium bone scan - look for bone metastases
- CT chest - look for pulmonary metastases

Note: In Ewing's sarcoma, bone marrow biopsy is performed to detect bone marrow metastases.

Correct Answer: Bone marrow biopsy, CT chest, and technetium bone scan

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3826. (3054) Q9-3561:

A 15-year-old boy has a destructive lesion in his proximal tibia. The magnetic resonance image shows soft tissue extension and a computed tomography scan of the chest shows no evidence of pulmonary metastases. The technetium bone scan shows a solitary lesion, and a needle biopsy shows a high-grade osteosarcoma. Which of the following is the correct surgical stage:

1) Stage IA
3) Stage IIA
2) Stage IB
5) Stage III
4) Stage IIB

Enneking System

IA	G1	T1	M0
IB	G1	T2	M0
IIA	G2	T1	M0
IIB	G2	T2	M0
IIIA	G1-G2	T1-T2	M1
IIIB	G1-G2	T1-T2	M1

Abbreviations: G=grade (G1 low: parosteal osteosarcoma, adamantinomma, chordoma; G2 high: osteosarcoma, Ewing's, malignant fibrous histiocytoma, dedifferentiated chondrosarcoma), T=site (T1: intracompartmental, T2: extracompartmental), M=metastases (M0: no metastases, M1: regional or distant).

Correct Answer: Stage IIB

3827. (3055) Q9-3562:

A 24-year-old man has a 1-year history of pain in his tibia. Plain radiographs show a lesion in the tibia with multiple lucent regions and intervening sclerosis. A computed tomography scan of the chest is negative, and a technetium bone scan shows a solitary lesion. The magnetic resonance image does not show any soft tissue extension, and a needle biopsy is consistent with an adamantinoma. Which of the following is the correct surgical stage:

1) Stage IA
3) Stage IIA
2) Stage IB
5) Stage IIII
4) Stage IIB

To answer this question, one must know that all adamantinomas are low-grade lesions. The suffix A is used when the tumor is intracompartmental (no soft tissue extension)

Enneking System

IA	G1	T1	M0
IB	G1	T2	M0
IIA	G2	T1	M0
IIB	G2	T2	M0
IIIA	G1-G2	T1-T2	M1
IIIB	G1-G2	T1-T2	M1

Abbreviations: G=grade (G1 low: parosteal osteosarcoma, adamantinomma, chordoma; G2 high: osteosarcoma, Ewing's, malignant fibrous histiocytoma, dedifferentiated chondrosarcoma), T=site (T1: intracompartmental, T2: extracompartmental), M=metastases (M0: no metastases, M1: regional or distant).

Correct Answer: Stage IA

3828. (3056) Q9-3563:

Which of the following locations is the most common for osteosarcomas:

1) Proximal humerus
3) Distal femur
2) Proximal femur
5) Proximal tibia
4) Distal tibia

The distal femur is the most common location for an osteosarcoma.

- Some tumors are prone to occur in certain locations. The following tumors have a common location:
  - Osteosarcoma - knee (distal femur, proximal tibia)
  - Parosteal osteosarcoma - distal femur (posterior cortex)
  - Chondrosarcoma - pelvis
  - Giant cell tumors - knee
  - Chordoma - sacrum
  - Adamantinoma - tibia

Correct Answer: Distal femur

3829. (3057) Q9-3564:

Which of the following is the most common location of giant cell tumor:

1) Distal radius
3) Proximal tibia
2) Proximal humerus
5) Sacrum
4) Distal femur

The knee is the most common location for a giant cell tumor.

- Some tumors are prone to occur in certain locations. The following tumors have a common location:
  - Osteosarcoma - knee (distal femur, proximal tibia)
  - Parosteal osteosarcoma - distal femur (posterior cortex)
  - Chondrosarcoma - pelvis
  - Giant cell tumors - knee
  - Chordoma - sacrum
  - Adamantinoma - tibia

Correct Answer: Distal femur

3830. (3058) Q9-3565:

Which of the following is the most common location of chondrosarcoma of bone:

1) Proximal femur
3) Pelvis
2) Distal femur
5) Proximal tibia
4) Proximal humerus

The most common location of a chondrosarcoma of bone is the pelvis.

- Some tumors are prone to occur in certain locations. The following tumors have a common location:
  - Osteosarcoma - knee (distal femur, proximal tibia)
  - Parosteal osteosarcoma - distal femur (posterior cortex)
  - Chondrosarcoma - pelvis
  - Giant cell tumors - knee
  - Chordoma - sacrum
  - Adamantinoma - tibia

Correct Answer: Pelvis

3831. (3059) Q9-3566:

Patients with high-grade intramedullary osteosarcoma are best treated with which of the following therapies:

1) Wide resection and chemotherapy
3) Wide resection, chemotherapy, and external beam irradiation
2) Wide resection, chemotherapy, and diphosphonates
5) Wide resection alone
4) Wide resection and external beam irradiation

Patients with high-grade intramedullary osteosarcoma are best treated with preoperative chemotherapy, wide surgical resection, and a variable duration of postoperative chemotherapy. External beam irradiation is not useful for treating patients with intramedullary osteosarcoma.

The most important prognostic factor is response to preoperative chemotherapy. When necrosis rates >95% are achieved, a more favorable prognosis can be expected.

Correct Answer: Wide resection and chemotherapy

3832. (3060) Q9-3567:

A 15-year-old boy has a Ewing's sarcoma of the proximal fibula. His staging studies are negative. A moderate-sized soft tissue mass is located circumferentially around the fibula. The soft tissue mass does not involve the neurovascular bundles. Which of the following treatment alternatives would be most appropriate:

1) Wide resection alone
3) Chemotherapy and wide resection
2) Above knee amputation alone
5) External beam irradiation alone
4) Wide resection followed by external beam irradiation

Ewing's sarcoma has a high propensity to metastasize to the lungs and bone. Without intensive chemotherapy, the 5-year survival is <25%. Patients are treated with systemic chemotherapy to control micro metastases and either external beam irradiation to the local site or wide surgical resection.

Wide surgical resection is often used for the sites that will not result in major morbidity. If the surgical margins are positive, then patients undergo external beam irradiation.

Correct Answer: Chemotherapy and wide resection

3833. (3061) Q9-3568:

A 25-year-old woman has a parosteal osteosarcoma of the distal femur. Which of the following treatments is the most appropriate:

1) Wide resection alone
3) Preoperative chemotherapy, wide resection, and external beam irradiation
2) Preoperative chemotherapy and wide resection
5) Curettage and grafting
4) Wide resection and external beam irradiation

Parosteal osteosarcomas are low-grade osteosarcomas. The risk of pulmonary metastasis is approximately 5%. Patients are treated with wide surgical resection alone. Chemotherapy and external beam irradiation are not useful for patients with parosteal osteosarcomas.

Correct Answer: Wide resection alone

3834. (3062) Q9-3569:

A 27-year-old man has a 1-year history of knee pain. A needle biopsy of the tibia shows an adamantinoma. Which of the following treatment options is most appropriate:

1) Wide resection alone
3) Wide resection and high-dose chemotherapy
2) Wide resection and low-dose chemotherapy
5) Curettage and bone grafting
4) Wide resection and external beam irradiation

Adamantinomas are low-grade malignancies. Adamantinomas have the potential to metastasize to the lungs, lymph nodes, and other bones. The risk of metastasis is low.

Adamantinomas are treated with wide surgical resection alone. Chemotherapy and external beam irradiation are not useful for patients with adamantinoma.

Correct Answer: Wide resection alone

3835. (3063) Q9-3570:

Which of the following treatment options is the most appropriate for a chordoma of the sacrum:

1) Wide resection alone
3) Wide resection and external beam irradiation
2) Wide resection and chemotherapy
5) Curettage and external beam irradiation
4) Curettage and diphosphonate therapy

Chordomas are low-grade malignant tumors that are best treated by wide resection. They can metastasize after a prolonged course of treatment with multiple local recurrences. Chordomas are difficult to remove, and there is a very high local failure rate.

Correct Answer: Wide resection alone

3836. (3064) Q9-3571:

Which of the following is the most appropriate treatment for patients with periosteal osteosarcoma:

1) Wide resection alone
3) Wide resection and chemotherapy
2) Wide resection and external beam irradiation
5) Curettage and grafting
4) Wide resection, chemotherapy, and external beam irradiation

Periosteal osteosarcomas are intermediate-grade malignancies. The risk of pulmonary metastases is approximately 15% to 30%. Patients are treated with chemotherapy and wide surgical resection. External beam irradiation is not useful for patients with periosteal osteosarcoma.

Correct Answer: Wide resection and chemotherapy

3837. (3065) Q9-3572:

Which of the following is the most appropriate treatment for patients with malignant fibrous histiocytoma of bone:

1) Wide resection alone
3) Wide resection and external beam irradiation
2) Wide resection and chemotherapy
5) Internal fixation and external beam irradiation
4) Curettage and bone grafting

Malignant fibrous histiocytoma of bone is usually a high-grade lesion with a marked propensity for both local recurrence and pulmonary metastases. Wide local resection is the only effective way to achieve local control. Chemotherapy is used when patients are healthy enough to undergo intensive regimens.

Correct Answer: Wide resection and chemotherapy

3838. (3066) Q9-3573:

Which of the following is the most appropriate treatment for patients with a grade 2 chondrosarcoma:

1) Wide resection alone
3) Wide resection and external beam irradiation
2) Wide resection and chemotherapy
5) Curettage and bone grafting
4) Curettage, cryotherapy, and bone grafting

Grade 2 chondrosarcomas have approximately a 20% to 30% risk of pulmonary metastases. In contrast to Grade 1 chondrosarcomas, they cause a greater degree of bone destruction and may extend into the soft tissues.

There is no role for chemotherapy or external beam irradiation. The role of curettage and adjuvant therapies, such as cryosurgery, is controversial for Grade 1 chondrosarcomas. Curettage should not be used for Grade 2 chondrosarcomas.

Correct Answer: Wide resection alone

3839. (3078) Q9-3586:

Which of the following factors causes osteoclast activation and bone destruction in multiple myeloma:

1) Osteoprotegerin (OPG)
3) Interferon
2) Transforming growth factor-beta (TGF-B)
5) Interleukin-4 (IL-4)
4) Receptor activator of nuclear factor-kB ligand (RANKL)

The bone destruction in multiple myeloma is caused by the release of RANKL from the osteoblast surface. The receptor activator of nuclear factor-kB ligand binds to a receptor activator of nuclear factor-kB (RANK) on the osteoclast progenitor cell surface, beginning the process of osteoclast activation and bone destruction. Osteoprotegerin is a decoy inhibitor of the system and halts osteoclast activation.

Factors that up regulate RANKL and down regulate OPG

- Parathyroid hormone, parathyroid hormone-related protein
- 1,25 dihydroxy vitamin D
- Interleukin-1beta
- Tumor necrosis factor alpha
- Prostaglandin E2

Factors that down regulate RANKL and up regulate OPG

- IL-4
- Interferon N gamma
- TGF-B

Factors that increase OPG expression

- Estrogen
- TGF-B

Correct Answer: Receptor activator of nuclear factor-kB ligand (RANKL)

3840. (3079) Q9-3587:

Which of the following factors is most likely produced by the plasma cells in multiple myeloma to facilitate osteoclast activation:

1) Transforming growth factor-beta (TFG-B)
3) Macrophage inflammatory factor-1 alpha (MIP-1A)
2) Interleukin-4 (IL-4)
5) Parathyroid hormone-related protein (PTHrP)
4) Osteoprotegerin (OPG)

The bone destruction in multiple myeloma is caused by the release of the receptor activator of nuclear factor-kB ligand (RANKL) from the osteoblast surface. Receptor activator of nuclear factor-kB ligand binds to a receptor activator of nuclear factor-kB (RANK) on the osteoclast progenitor cell surface, beginning the process of osteoclast activation and bone destruction. Osteoprotegerin is a decoy inhibitor of the system and halts osteoclast activation.

Factors in multiple myeloma that cause osteoclast activation

- IL-6
- MIP-1A (acts directly on osteoclast precursors)

Factors that up regulate RANKL and down regulate OPG

- Parathyroid hormone, PTHrP
- 1,25 dihydroxy vitamin D
- IL-1B
- Tumor necrosis factor-alpha
- Prostaglandin E2

Factors that down regulate RANKL and up regulate OPG

- IL-4
- Interferon N gamma
- TGF-B

Correct Answer: Macrophage inflammatory factor-1 alpha (MIP-1A)

3841. (3080) Q9-3588:

Which of the following factors is most likely produced by the plasma cells in multiple myeloma to facilitate osteoclast activation:

1) Transforming growth factor beta (TGF-B)
3) Interleukin 6 (IL-6)
2) Interleukin 4 (IL-4)
5) Parathyroid hormone-related protein (PTHrP)
4) Osteoprotegerin (OPG)

The bone destruction in multiple myeloma is caused by release of the receptor activator of nuclear-kB ligand (RANKL) from the osteoblast surface. The receptor activator of nuclear-kB ligand binds to a receptor activator of nuclear-kB (RANK) on the osteoclast progenitor cell surface, and the process of osteoclast activation and bone destruction begins. Osteoprotegerin is a decoy inhibitor of the system and halts osteoclast activation.

Factors in multiple myeloma that cause osteoclast activation

- IL-6
- Macrophage inflammatory factor-alpha (acts directly on osteoclast precursors)

Factors that up regulate RANKL and down regulate OPG

- Parathyroid hormone, PTHrP
- 1,25 dihydroxy vitamin D
- IL-1 beta
- Tumor necrosis factor-alpha
- Prostaglandin E2

Factors that down regulate RANKL and up regulate OPG

- IL-4
- Interferon N gamma
- TGF-B

Correct Answer: Interleukin 6 (IL-6)

3842. (3081) Q9-3589:

Which of the following agents inhibits bone destruction:

1) Receptor activator of nuclear-kB ligand (RANKL)
3) Interleukin-6 (IL-6)
2) Macrophage inflammatory factor-1alpha (MIP-1A)
5) Parathyroid hormone-related protein (PTHrP)
4) Osteoprotegerin (OPG)

The bone destruction in multiple myeloma is caused by the release of RANKL from the osteoblast surface. The receptor activator of nuclear-kB ligand binds to a receptor activator of nuclear-kB (RANK) on the osteoclast progenitor cell surface, beginning the process of osteoclast activation and bone destruction. Osteoprotegerin is a decoy inhibitor of the system and halts osteoclast activation.

Factors in multiple myeloma that cause osteoclast activation

- IL-6
- MIP-1A (acts directly on osteoclast precursors)

Factors that up regulate RANKL and down regulate OPG

- PTHrP
- 1,25 dihydroxy vitamin D
- IL-1 beta
- Tumor necrosis factor-alpha
- Prostaglandin E2

Factors that down regulate RANKL and up regulate OPG

- Interleukin-4
- Interferon N gamma
- Transforming growth factor-beta

Correct Answer: Osteoprotegerin (OPG)

3843. (3082) Q9-3590:

Which of the following conditions are poor prognostic factors in multiple myeloma:

1) Increased serum albumin
3) Decreased bone marrow microvessels
2) Decreased serum beta 2 (B2) microglobulin
5) Increased serum alkaline phosphatase
4) Deletion of chromosome 13

Multiple myeloma is a malignant plasma dyscrasia characterized by monoclonal gammopathy and a constellation of bone lesions, renal failure, anemia, and hypercalcemia.

Diagnostic criteria

- At least 10% of plasma cells in the bone marrow are affected
- Monoclonal protein in the serum or urine
- End organ damage
    - Hypercalcemia
    - Renal insufficiency
    - Anemia
    - Bone lesions (lytic destruction)

Poor prognostic factors

- Complete deletion of chromosome 13 or its long arm
- Translocations, t(4;14), 4(14;16)
- Increased bone marrow microvessels
- Increased plasma cell labeling index
- Increased serum B2 microglobulin
- Decreased serum albumin
- Circulating plasma cells

Correct Answer: Deletion of chromosome 13

3844. (3083) Q9-3591:

Which of the following agents are poor prognostic factors in multiple myeloma:

1) Increased serum albumin
3) Increased serum alkaline phosphatase
2) Increased serum beta 2 (B2) microglobulin
5) Increased serum hemoglobin
4) Decreased bone marrow microvessels

Multiple myeloma is a malignant plasma dyscrasia that is characterized by monoclonal gammopathy and a constellation of bone lesions, renal failure, anemia, and hypercalcemia.

Diagnostic criteria

- At least 10% of plasma cells in the bone marrow are affected
- Monoclonal protein in the serum or urine
- End organ damage
    - Hypercalcemia
    - Renal insufficiency
    - Anemia
    - Bone lesions (lytic destruction)

Poor prognostic factors

- Complete deletion of chromosome 13 or its long arm
- Translocations, t(4;14), 4(14;16)
- Increased bone marrow microvessels
- Increased plasma cell labeling index
- Increased serum B2 microglobulin
- Decreased serum albumin
- Circulating plasma cells

Correct Answer: Increased serum beta 2 (B2) microglobulin

3845. (3092) Q9-3601:

Which of the following correctly describes a chordoma:

1) Aggressive benign neoplasm
3) Developmental anomaly
2) Aggressive reactive process
5) High-grade malignancy
4) Low-grade malignancy

A chordoma is a low-grade malignancy that has a high rate of local recurrence, but a low risk of metastasis. Although the 10-year survival rate is only approximately 25%, the majority of patients die from local spread rather than from metastases.

A number of lesions may occur in the sacrum:

Reactive processes:

- Aneurysmal bone cyst
- Stress fracture

Benign aggressive neoplasm:

- Giant cell tumor

High-grade malignancies:

- Metastases
- Myeloma
- Osteosarcoma
- Ewing's tumor
- Chondrosarcoma

Correct Answer: Low-grade malignancy

3846. (3093) Q9-3602:

Which of the following describes the correct treatment of a sacral chordoma:

1) Preoperative chemotherapy and wide resection
3) Wide resection alone
2) Wide resection and postoperative chemotherapy
5) External beam irradiation
4) Curettage and bone grafting

A chordoma is a low-grade malignancy that has a high rate of local recurrence, but a low risk of metastasis. Although the 10-year survival rate is only approximately 25%, the majority of patients die from local spread rather than from metastases.

Chordomas are treated by wide resection alone. There is no role for chemotherapy. External beam irradiation can be used for locally recurrent cases, but it seldom cures this condition.

Correct Answer: Wide resection alone

3847. (3094) Q9-3604:

Which of the following describes the histological features of chordoma:

1) Clusters of epithelial cells in a fibrous background
3) Uniform population of giant cells in a mononuclear cell background
2) Sheets of plasma cells
5) Uniform population of small blue cell
4) Large cells with vacuolated cytoplasm in a mucous background

A chordoma is a low-grade malignancy that has a high rate of local recurrence, but a low risk of metastasis. Although the 10-year survival rate is only approximately 25%, the majority of patients die from local spread rather than from metastases.

A. Cells have vacuolated cytoplasm and are in a myxoid intercellular matrix. Cords or sheets of cells are embedded in an abundant, pale extracellular matrix.
B. Physaliferous cells are centrally located nucleus with a narrow rim of cytoplasm surrounded by vacuolated cytoplasm.
    1. Intracellular vacuoles
        a. Vary in size from small to large
    2. Sometimes present in small numbers
C. Syncytial strands of cells
    1. Lying in a mass of mucous
    2. Cell boundaries are indistinct

Immunochemistry stains show positivity for S-100, keratin, and epithelial membrane antigen (EMA.

Correct Answer: Large cells with vacuolated cytoplasm in a mucous background

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3848. (3138) Q9-3957:

Which of the following statements is true regarding lipoma arborescens:

1) Lipoma arborescens is a relatively common condition.
3) Microscopic appearance is not characteristic in lipoma arborescens.
2) The synovium does not have macroscopic pathology.
5) Symptoms of lipoma arborescens include diffuse joint swelling and repeated locking.
4) Arthroscopy is not helpful in treating patients with lipoma arborescens.

In patients with lipoma arborescens, joint swelling, repeated locking, and joint effusions are present.

- Only a few cases of lipoma arborescens have been reported.
- Macroscopically, the entire synovium is thickened in patients with lipoma arborescens.
- Histologically, the sub-synovium contains typical mature fatty tissue.
- The diagnosis of lipoma arborescens can be made at arthroscopy.

Correct Answer: Symptoms of lipoma arborescens include diffuse joint swelling and repeated locking.

3849. (3139) Q9-3958:

The management of lipoma arborescens includes:

1) Differential diagnosis includes cruciate ligament lesions and patella chondromalatia.
3) Joint effusion can be obtained via puncture.
2) Magnetic resonance imaging is not useful in diagnosis.
5) Synovectomy is the treatment of choice.
4) Lipoma arborescens often occurs in various upper limb joints.

Synovectomy is an effective treatment with excellent results and a low recurrence rate.

- Lipoma arborescens should be differentiated from villonodular synovitis and synovial hemangioma.
- Magnetic resonance imaging enables diagnosis at an early stage.
- Effusion cannot be used in cases of lipoma arborescens.
- The primary location of lipoma arborescens is the knee joint.

Correct Answer: Synovectomy is the treatment of choice.

3850. (3140) Q9-3959:

Pigmented villonodular synovitis (PVNS):

1) May exclusively involve synovial joint membranes
3) Always appears localized
2) Never involves bursae
5) Has no connection with giant cell tumor of the tendon sheath
4) Is classified as a benign proliferative lesion

Villonodular synovitis is a group of benign proliferative lesions of the synovium and the mesenchymal supporting elements, tendon sheaths, and bursae.

- PVNS may involve the synovial lining of joints, tendon sheaths, and bursae (pigmented villonodular bursitis).
- PVNS can be further subdivided to a diffuse and a localized form.
- A form of PVNS is also called giant cell tumor of the tendon sheath.

Correct Answer: Is classified as a benign proliferative lesion

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3851. (3141) Q9-3960:

Pigmented villonodular synovitis (PVNS):

1) Has no connection with chromosomal abnormalities
3) Does not recur after excision
2) Occurs mainly in elderly women
5) Is considered an inflammation of the synovium
4) Is considered a benign neoplasm of the synovium

Based on cytogenetic studies and other histology findings, villonodular synovitis is considered a benign neoplasm of the synovium.

- Several chromosomal abnormalities such as trisomy 7 [40], aberration of short arm of chromosome 1 [41] and x chromosome inactivation [42] have been reported.
- PVNS affects all age groups and both male and female patients.
- PVNS has a propensity to recur after excision.

Correct Answer: Is considered a benign neoplasm of the synovium

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3852. (3142) Q9-3961:

Symptoms of pigmented villonodular synovitis (PVNS):

1) Never appear on the joints of the upper limb
3) Do not result in locking of the joint
2) Cause no changes on the bone
5) Always cause painless swelling
4) Usually involves the knee

The diffuse form of PVNS usually involves the knee as a monoarthropathy. Apart from the knee, this disorder has been described in the ankle, hip, wrist, spine, shoulder, and temporomandibular joint.

- PVNS lesions presented in giant cell tumor of the tendon sheath are the most common soft tissue tumor of the hand. The presenting symptom in this lesion is a painless mass on a finger.
- Ten percent to 25% of the lesions cause erosion and atrophic pressure on the underlying cortical bone.
- Intra-articular PVNS, a rare manifestation of the disorder, can present with pain and locking of the joint.
- The pedunculated nodules can undergo torsion and infarction, leading to acute pain.

Correct Answer: Usually involves the knee

3853. (3143) Q9-3962:

Which of the following statements regarding pigmented villonodular synovitis (PVNS) is true:

1) Magnetic resonance imaging does not contribute to diagnosis and treatment planning.
3) Marginal surgical excision of the giant cell tumor of the tendon sheath is the treatment of choice. In the knee joint, successful arthroscopic removal of the lesion has also been reported.
2) Blood collection in the knee excludes PVNS.
5) Osmic acid synovectomy is useless.
4) The recurrence rate is high.

Localized or focal forms of PVNS can be successfully treated with arthroscopic partial synovectomy. Radiation treatment is generally reserved for high-risk patients when the extent of the lesion makes it inoperable or in patients who have recurrent PVNS after surgery.

- Magnetic resonance imaging is especially useful for delineating the extent of the lesion to assist in surgical planning.
- Hemorrhage of joints is common.
- The recurrence rate is low and is dependent on the degree of technical difficulty. Adequately excised lesions do not recur.
- Osmic acid or radiation synovectomy is proposed when surgery cannot be performed.

Correct Answer: Marginal surgical excision of the giant cell tumor of the tendon sheath is the treatment of choice. In the knee joint, successful arthroscopic removal of the lesion has also been reported.

3854. (3144) Q9-3963:

Which of the following statements is true regarding synovial chondroma:

1) Synovial chondroma is frequently seen in clinics.
3) Synovial chondroma predominantly occurs on major limb joints.
2) Synovial chondroma may present in extensive size.
5) Synovial chondroma grows rapidly.
4) Synovial chondroma is exclusively found on the hands and feet.

Synovial chondromas appear around the small joints of the hands in 64% of patients and of the feet in 20% of patients.

- Synovial chondroma is a rare chondroid tumor.
- Synovial chondroma does not grow larger than 2 cm.
- Synovial chondroma is a slow growing tumor; therefore, clinical symptoms are generally aspecific.

Correct Answer: Synovial chondroma is exclusively found on the hands and feet.

3855. (3145) Q9-3964:

Synovial chondroma:

1) Is frequently seen in childhood
3) Must be differentiated from chondrosarcoma of the hand
2) Has no distinct radiographic appearance
5) Commonly recurs
4) Is not adequately treated by marginal surgical excision

Synovial chondroma must be distinguished from giant cell tumor of the tendon sheath, synovial chondromatosis, and chondrosarcoma of the hand. Chondrosarcoma grows more rapidly than synovial chondroma and involves the surrounding bones.

- The lesions develop at any age, although they are more frequent in the third and fourth decades.
- Radiographs often show a lobular appearance on the palmar or dorsal side of the small joints, with various calcifications and ossifications.
- Marginal surgical excision is the treatment choice, which is generally not followed by recurrence.

Correct Answer: Must be differentiated from chondrosarcoma of the hand

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3856. (3146) Q9-3965:

Synovial hemangioma:

1) Is an atypical non-infectious inflammation
3) May be a part of a generalized hemangiomatosis syndrome
2) Mainly appears in young boys
5) Is always localized
4) Is relatively common

Synovial hemangioma may be a part of a heterogenous syndrome, involving hemangiomas of the skin, bone, and muscles (Klippel-Trenaunay-Weber disease).

- Synovial hemangioma is a proliferation of blood vessels arising in a synovium-lined surface.
- Synovial hemangioma appears at any age and involves both men and women.
- Synovial hemangioma is rare.
- Synovial hemangioma appears in either a localized or diffuse form.

Correct Answer: May be a part of a generalized hemangiomatosis syndrome

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3857. (3147) Q9-3966:

In patients with synovial hemangioma:

1) Severe pain of the involved joint is characteristic
3) Surgical excision is ineffective
2) Hemarthrosis of different origin is rare
5) Histology is not distinctive
4) Arthroscopy may reveal a pathognomic peduncular purple-blue tumor

During arthroscopy, occasionally a peduncular, purple-blue tumor is pathognomic.

- Clinical symptoms are mild in patients with synovial hemangioma.
- In the differential diagnoses, pigmented villonodular synovitis, hemarthrosis of traumatic origin, meniscal lesions, and other causes of hemarthrosis should be considered.
- Surgical excision is indicated, if possible, at an early stage before the slowly progressing lesion infiltrates the articular synovium.
- The histology shows hemangioma of capillary or cavernous type.

Correct Answer: Arthroscopy may reveal a pathognomic peduncular purple-blue tumor

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3858. (3148) Q9-3967:

Which of the following statements is true regarding synovial osteochondromatosis:

1) Primary synovial chondromatosis is a rare tumor-like lesion.
3) Synovial chondromatosis is a poorly delineated histological entity.
2) Synovial osteochondromatosis is based exclusively on cartilaginous metaplasia.
5) Etiology is clarified.
4) Subsynovial metaplastic chondroid islands can be misleading.

Primary synovial chondromatosis is an uncommon tumor-like lesion.

- Synovial osteochondromatosis is based on cartilaginous metaplasia, originating from the synovium.
- The condition is not a simple metaplasia but has a proliferative component, as well.
- Synovial chondromatosis is a histologically verified entity with subsynovial metaplastic chondroid islands.
- The etiology of the process is unknown.

Correct Answer: Primary synovial chondromatosis is a rare tumor-like lesion.

3859. (3149) Q9-3968:

Which of the following statements is true regarding synovial osteochondromatosis:

1) Synovial osteochondromatosis occurs mainly in women.
3) Synovial osteochondromatosis usually develops polyarticularly.
2) Synovial osteochondromatosis occurs predominantly in children.
5) Range of motion is always limited in patients with synovial osteochondromatosis.
4) Synovial osteochondromatosis is characterized by swelling.

The leading symptom in synovial osteochondromatosis is swelling of the affected joint.

- Found equally in men and women
- Occurs between 30 and 50 years of age
- Condition is rarely polyarticular
- May develop without limitation of movement

Correct Answer: Synovial osteochondromatosis is characterized by swelling.

3860. (3150) Q9-3969:

Regarding synovial osteochondromatosis imaging:

1) Presents as narrowing the affected joint space on radiograph
3) Widening of the articular joint space is an indirect radiographic sign
2) Even at the early stage, calcified loose bodies of various sizes show on radiographs
5) Calcified loose bodies are uncommon in any other entity
4) Magnetic resonance imaging and computed tomography are not helpful at the early stage

Radiographs show widening of the articular joint space due to joint effusion.

- Calcified loose bodies appear only at later stage
- Magnetic resonance imaging and computed tomography detect chondromas at early stage
- Calcified loose bodies are also present in osteochondritis dissecans and advanced osteoarthritis

Correct Answer: Widening of the articular joint space is an indirect radiographic sign

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3861. (3151) Q9-3970:

Which of the following treatment options is best for synovial osteochondromatosis:

1) Nonsteroidal anti-inflammatory drugs
3) Open arthrotomy and total synovectomy
2) Arthroscopic surgery to remove loose chondromas and partial synovectomy to prevent locking episodes and pain
5) Malignant transformation often occurs
4) Recurrence rate after surgery is more than 60%

Partial synovectomy and arthroscopic surgery is usually appropriate.

- Nonsteroidal anti-inflammatory drugs provide only some relief of symptoms
- Open surgery is not necessary because the entire synovium is not involved
- The rate of recurrence is estimated to be 15% to 25%
- Synovial chondromatosis can become malignant

Correct Answer: Arthroscopic surgery to remove loose chondromas and partial synovectomy to prevent locking episodes and pain

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3862. (3152) Q9-3971:

Which of the following statements regarding synovial sarcomas is true:

1) Synovial sarcomas are rare malignant soft tissue tumors.
3) A synovial sarcoma is usually located in the vicinity of spine.
2) Convincing histological evidence shows that synovial sarcomas originate from the cells of the synovium.
5) Synovial sarcoma can be mistaken for synovitis or a ganglion.
4) Synovial sarcomas never cause pain.

A synovial sarcoma may persist for years as a small, superficial, indolent lump in the hands or feet. It can be mistaken for synovitis or a ganglion.

- Synovial sarcoma is the third most frequent malignant soft tissue tumor; accounting for 5% to 10% of all soft tissue tumors.
- This tumor was designated as a synovial sarcoma because of its anatomical location (most of them originate from the capsules of the joints, bursae, and tendon sheaths) and its histological similarity to normal synovial tissue. No convincing evidence exists that the tumor originates from the cells of the synovium.
- A synovial sarcoma is usually located in the extremities (90%) and the lower limbs (60%).
- Deep, radiating pain is present in about 50% of patients.

Correct Answer: Synovial sarcoma can be mistaken for synovitis or a ganglion.

3863. (3153) Q9-3972:

Which of the following statements is true regarding the diagnosis of synovial sarcoma:

1) Radiograph shows no specific signs.
3) Ultrasound can easily differentiate synovial sarcoma from other benign cysts.
2) Magnetic resonance imaging exhibits lobular structure and extent.
5) Synovial sarcoma does not have cytogenetic abnormality.
4) Synovial sarcoma does not infiltrate the viscera and muscles.

Magnetic resonance imaging is the best tool for detection of the lesion's lobular structure and extent.

- The tumor may be recognized on conventional plain radiographic films because tissue calcification occurs in approximately 20% to 40% of patients.
- Ultrasound may be helpful in distinguishing the tumor, mainly from Baker cysts in the popliteal region, although in many patients, the synovial sarcoma may contain large multicompartmental cysts filled with mucoid substance similar to synovial fluid.
- In the later stages, synovial sarcoma starts to spread into the viscera and muscles, infiltrating the surrounding joints and bones.
- The reciprocal translocation t(X; 18) (p 11.2; q 11.2) is thought to be the primary cytogenetic abnormality and specific to synovial sarcoma. By cytogenetic examinations, tumor-specific chimeric transcripts such as SYT-SSX1, SYT-SSX2 can be revealed in the synovial sarcoma, which are also highly specific for the tumor.

Correct Answer: Magnetic resonance imaging exhibits lobular structure and extent.

3864. (3154) Q9-3973:

Which of the following statements is true regarding the management of synovial sarcoma:

1) The survival rate for synovial sarcoma depends on the stage of the tumor and has been estimated at 25% to 60%.
3) Risk factors for local recurrence do not include tumor size and surgical margins.
2) Amputation is indicated to avoid local recurrence.
5) The localization or histological (mono- or biphasic) type of the tumor are significant prognostic factors.
4) Risk factors for tumor-related death are unrelated to histological differentiation, tumor size, age, and development of local recurrence.

The 5-year survival rate for synovial sarcoma depends on the stage of the tumor and has been estimated at 25% to 60%.

- The results of limb-sparing surgery are no worse than amputation if wide excision is performed.
- Risk factors for local recurrence include large tumor size (more than 5 cm) and inadequate surgical margins.
- Risk factors for tumor-related death are poor histological differentiation, large tumor size, age older than 25 years, and development of local recurrence.
- The localization or histological (mono- or biphasic) type of the tumor are not considered to be significant prognostic factors.

Correct Answer: The survival rate for synovial sarcoma depends on the stage of the tumor and has been estimated at 25% to 60%.

3865. (3302) Q9-4148:

Which of the following factors is most likely responsible for hypercalcemia of malignancy:

1) Insulin-like growth factor 1
3) TGF beta
2) p53 protein
5) PTHrP
4) IL-6

PTHrP is the most likely factor that causes hypercalcemia of malignancy. PTHrP is released form the cancer cells (as in breast carcinoma). The PTHrP then causes the RANKL to be released from osteoblasts and marrow stromal cells. The RANKL then attaches to the RANK receptor on the osteoclast precursor cells. If MCS-F (macrophage colony stimulating factor) is present, the osteoclast precursor cells then differentiate into osteoclasts and resorb the cortical and trabecular bone. When the organic and inorganic components of the bone are resorbed, calcium is released.Correct Answer: PTHrP

3866. (3303) Q9-4149:

In which of the following tumors do p53 mutations occur:

1) Neurofibromatosis and multiple hereditary exostoses
3) Retinoblastoma and desmoid tumors
2) Osteosarcoma and high-grade chondrosarcoma
5) Retinoblastoma and multiple hereditary exostoses
4) Neurofibromatosis and desmoid tumor

P53 mutations occur commonly in osteosarcoma, high-grade chondrosarcomas, and soft tissue sarcomas. P53 and retinoblastoma are the two most important tumor suppressor genes.

P53 mutations may result in a syndrome called Li-Fraumeni syndrome. Patients may develop breast cancer, osteogenic sarcoma, soft tissue sarcomas, and other malignancies.

One should remember the major tumor suppressor genes in musculoskeletal conditions:

- Retinoblastoma (RB) gene â retinoblastoma, osteosarcoma
- p53 â osteosarcoma, high-grade chondrosarcoma, soft tissue sarcomas
- P16INK4a â familial melanoma â chondrosarcoma, osteosarcoma, melanoma
- APC â familial adenomatous polyposis â colon adenomas, desmoid tumors
- NF1 â neurofibromatosis 1 â neurofibroma, sarcoma
- EXT1, EXT2 â hereditary multiple exostosis â osteochondromas, chondrosarcoma

Correct Answer: Osteosarcoma and high-grade chondrosarcoma

3867. (3304) Q9-4150:

Which of the following malignancies other than retinoblastoma most commonly affects patients with a mutation in the retinoblastoma (RB) gene:

1) Chondrosarcoma
3) Neurofibrosarcoma
2) Malignant fibrous histiocytoma
5) Breast cancer
4) Osteosarcoma

Patients who have mutation in the retinoblastoma gene are prone to develop retinoblastoma. Osteosarcoma is the second most common malignancy to develop in these patients.

One should remember the major tumor suppressor genes in musculoskeletal conditions:

- Retinoblastoma (RB) gene â retinoblastoma, osteosarcoma
- p53 â osteosarcoma, high-grade chondrosarcoma, soft tissue sarcomas
- P16INK4a â familial melanoma â chondrosarcoma, osteosarcoma, melanoma
- APC â familial adenomatous polyposis â colon adenomas, desmoid tumors
- NF1 â neurofibromatosis 1 â neurofibroma, sarcoma
- EXT1, EXT2 â hereditary multiple exostosis â osteochondromas, chondrosarcoma

Correct Answer: Osteosarcoma

3868. (3305) Q9-4151:

Which of the following blocks the restriction checkpoint in the cell cycle (prohibits cells from passing from G1 to the S [synthesis] phase):

1) E2F
3) Cyclin-dependent kinases
2) RB gene
5) p53
4) INK (inhibitor of CDK4)

The retinoblastoma (RB) gene controls the checkpoint in regard to cells passing from the G1 (or G0 resting phase) into S, or synthesis, phase.

One should remember that the RB gene is phosphorylated by cyclin-dependent kinases (CDKs). When the RB protein is phosphorylated, it dissociates from E2f, which is a transcription factor for a number of enzymes for DNA synthesis.

The CDK inhibitors block the cell from progressing through the synthesis phase. These inhibitors include:

- p21WAF/Cip1, p27Kip1, p57Kip2
- INK

The important point is to remember that the retinoblastoma gene is a tumor suppressor gene and it controls the restriction point of the cell cycle.

Correct Answer: RB gene

3869. (3306) Q9-4156:

Which of the following describes apoptosis:

1) IL-6-mediated inflammation
3) PTHrP-mediated bone resorption
2) TNF-mediated inflammation
5) E2F transcription factor activation of enzymes for DNA synthesis
4) Programmed cell death

Apoptosis is programmed cell death. This process is characterized by nuclear condensation, DNA fragmentation, and cell shrinkage. The cysteine proteases play an important role for enzymatic degradation.

One should remember that chemotherapy works in general by inducing programmed cell death (or apoptosis). The various agents damage the DNA, which causes induction of the apoptic pathways.

Correct Answer: Programmed cell death

3870. (3307) Q9-4157:

Which of the following may account for the predisposition of breast carcinoma cells to metastasize to bone:

1) PTHrP
3) Integrins
2) RANKL
5) E-cadherin
4) p53

Integrins are membrane receptors that heavily influence cell migration and attachment. They recognize the RGD (Arg-Gly-Asp) peptide on extracellular matrix molecules. The role of integrins may be important in breast carcinoma metastasis to bone.

Cadherins are cell adhesion molecules. When breast carcinoma cells lose E-cadherins, there may be an enhanced ability to metastasize.

Correct Answer: Integrins

3871. (3308) Q9-4158:

Which of the following has been found in chondrosarcomas and may indicate the degree of malignancy:

1) RB
3) MMPs (matrix metalloproteinases)
2) p53
5) PTHrP
4) TIMPs

Matrix metalloproteinases (MMPs) may play an important role in the degree of malignancy of chondrosarcomas. These enzymes have the ability to degrade the extra-cellular matrix. Matrix metalloproteinases include collagenases, gelatinases, and stromelysins.

Tissue inhibitors of metalloproteinases (TIMPs) act to hold these derivative enzymes in check to prevent unwanted destruction.

Correct Answer: MMPs (matrix metalloproteinases)

3872. (3309) Q9-4159:

Which of the following is associated with a more favorable prognosis in synovial sarcoma:

1) Size >5 cm
3) SYT-SSX1 fusion product
2) Location below the fascia
5) Single regional lymph node metastasis
4) SYT-SSX2 fusion product

The SYT-SSX1 fusion product is associated with a better prognosis than the SYT-SSX2 gene fusion.

All of the other responses portend a poor prognosis.

Poor prognostic factors in synovial sarcoma:

- Presence of lymph node or pulmonary metastasis
- Size >5 cm
- Location below the fascia
- gene fusion product SYT-SSX2

Correct Answer: SYT-SSX1 fusion product

3873. (3310) Q9-4162:

Which of the following is the major effect of chemotherapy in the treatment of osteosarcoma:

1) Improves local control
3) Reduces the risk for brain metastases
2) Reduces the risk for bone metastases
5) Reduces the risk for skin metastases
4) Reduces the risk for pulmonary metastases

The major effect of chemotherapy in treating patients with osteosarcoma is reducing the risk of pulmonary metastases. Prior to the advent of multi-agent chemotherapy, the survival of children with osteosarcoma was only 10% to 20% because of pulmonary metastases. With current preoperative and postoperative chemotherapy regimens, the survival has improved to 70%.Correct Answer: Reduces the risk for pulmonary metastases

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3874. (3311) Q9-4163:

Which of the following controls the transition from the G1 to S phase by recognizing DNA damage and halting cell cycle progression:

1) Retinoblastoma protein
3) E2F
2) Cyclin D
5) p53 protein
4) CDK4

The p53 protein is referred to as the âguardian of the genome.â The p53 protein detects DNA damage and halts progression of the cell cycle (synthesis of DNA and replication). This protein either halts synthesis, allowing DNA repair, or, if the cell is past the restriction point, p53 induces programmed cell death (apoptosis).

If DNA damage occurs, then the p53 protein is induced. The increase in p53 causes an increase in p21, which prevents phosphorylation of the retinoblastoma protein. One should remember that phosphorylation of the retinoblastoma protein leads to the transcription of various factors that are necessary for DNA synthesis.

Correct Answer: p53 protein

3875. (3312) Q9-4164:

Which of the following pathways must be inactivated for tumor cell growth:

1) Receptor activator of nuclear factor-kB ligand/receptor activator nuclear factor-kB
3) Transforming growth factor beta/insulin-like growth factor 1
2) Receptor activator of nuclear factor-kB ligand/osteoprotegerin
5) Tumor necrosis factor
4) Retinoblastoma

The retinoblastoma and p53 pathways are the two major regulators of the cell cycle progression from the resting phase to the S or synthesis phase. One should remember that phosphorylation of the retinoblastoma protein results in release of transcription factors, whereas the p53 pathway detects genetic damage and halts phosphorylation of the retinoblastoma protein.

Both of these pathways must be damaged to have progression of tumor cells through cell growth.

Correct Answer: Retinoblastoma

3876. (3313) Q9-4165:

Which of the following pathways must be inactivated for tumor cell growth:

1) Receptor activator of nuclear factor-kB ligand/receptor activator nuclear factor-kB
3) Transforming growth factor beta/insulin-like growth factor 1
2) Receptor activator of nuclear factor-kB ligand/osteoprotegerin
5) Tumor necrosis factor/interleukin 6
4) p53

The retinoblastoma and p53 pathways are the two major regulators of the cell cycle progression from the resting phase to the S or synthesis phase. One should remember that phosphorylation of the retinoblastoma protein results in release of transcription factors, whereas the p53 pathway detects genetic damage and halts phosphorylation of the retinoblastoma protein.

Both of these pathways must be damaged to have progression of tumor cells through cell growth.

Correct Answer: p53

3877. (3314) Q9-4167:

In which of the following cancers has chemotherapy shown an improvement in survival:

1) Sarcoma occurring in Pagetâs disease
3) Parosteal osteosarcoma
2) Dedifferentiated chondrosarcoma
5) High-grade intramedullary chondrosarcoma
4) High-grade intramedullary osteosarcoma

Chemotherapy has dramatically improved the survival rate of patients with high-grade intramedullary osteosarcoma and Ewingâs tumor. The disease-free survival rate without chemotherapy is less than 20% for patients, whereas with modern multi-agent regimens, the disease-free survival rate approaches 70%. Periosteal osteosarcoma is an intermediate-grade osteosarcoma (risk of pulmonary metastases is 15% to 25%), which is generally treated with the same chemotherapy regimen as high-grade intramedullary osteosarcoma.

Chemotherapy has been used for a number of high-grade sarcomas with disappointing results:

- Dedifferentiated chondrosarcoma
- High-grade intramedullary chondrosarcoma
- Sarcoma following Pagetâs disease

Chemotherapy has no use with low-grade sarcomas:

- Well-differentiated intramedullary osteosarcoma
- Parosteal osteosarcoma
- Low-grade intramedullary chondrosarcoma
- Adamantinoma
- Chordoma

Correct Answer: High-grade intramedullary osteosarcoma

3878. (3315) Q9-4168:

In which of the following cancers has chemotherapy shown an improvement in survival:

1) Dedifferentiated chondrosarcoma
3) Ewingâs tumor
2) Sarcoma complicating Pagetâs disease
5) High-grade intramedullary chondrosarcoma
4) Parosteal osteosarcoma

Chemotherapy has dramatically improved the survival rate of patients with high-grade intramedullary osteosarcoma and Ewingâs tumor. The disease-free survival rate without chemotherapy is less than 20% for patients, whereas with modern multi-agent regimens, the disease-free survival rate approaches 70%. Periosteal osteosarcoma is an intermediate-grade osteosarcoma (risk of pulmonary metastases is 15% to 25%), which is generally treated with the same chemotherapy regimen as high-grade intramedullary osteosarcoma.

Chemotherapy has been used for a number of high-grade sarcomas with disappointing results:

- Dedifferentiated chondrosarcoma
- High-grade intramedullary chondrosarcoma
- Sarcoma following Pagetâs disease

Chemotherapy has no use with low-grade sarcomas:

- Well-differentiated intramedullary osteosarcoma
- Parosteal osteosarcoma
- Low-grade intramedullary chondrosarcoma
- Adamantinoma
- Chordoma

Correct Answer: Ewingâs tumor

3879. (3316) Q9-4169:

Chemotherapy has no role in the treatment of which of the following tumors:

1) High-grade intramedullary osteosarcoma
3) Periosteal osteosarcoma
2) Ewingâs tumor
5) Multiple myeloma
4) Parosteal osteosarcoma

Chemotherapy has dramatically improved the survival rate of patients with high-grade intramedullary osteosarcoma and Ewingâs tumor. The disease-free survival rate without chemotherapy is less than 20% for patients, whereas with modern multi-agent regimens, the disease-free survival rate approaches 70%. Periosteal osteosarcoma is an intermediate-grade osteosarcoma (risk of pulmonary metastases is 15% to 25%), which is generally treated with the same chemotherapy regimen as high-grade intramedullary osteosarcoma.

Chemotherapy has been used for a number of high-grade sarcomas with disappointing results:

- Dedifferentiated chondrosarcoma
- High-grade intramedullary chondrosarcoma
- Sarcoma following Pagetâs disease

Chemotherapy has no use with low-grade sarcomas:

- Well-differentiated intramedullary osteosarcoma
- Parosteal osteosarcoma
- Low-grade intramedullary chondrosarcoma
- Adamantinoma
- Chordoma

Correct Answer: Parosteal osteosarcoma

3880. (3317) Q9-4170:

Chemotherapy has no role in the treatment of which of the following tumors:

1) High-grade surface osteosarcoma
3) Adamantinoma
2) High-grade intramedullary osteosarcoma
5) Ewingâs tumor
4) Periosteal osteosarcoma

Chemotherapy has dramatically improved the survival rate of patients with high-grade intramedullary osteosarcoma and Ewingâs tumor. The disease-free survival rate without chemotherapy is less than 20% for patients, whereas with modern multi-agent regimens, the disease-free survival rate approaches 70%. Periosteal osteosarcoma is an intermediate-grade osteosarcoma (risk of pulmonary metastases is 15% to 25%), which is generally treated with the same chemotherapy regimen as high-grade intramedullary osteosarcoma.

Chemotherapy has been used for a number of high-grade sarcomas with disappointing results:

- Dedifferentiated chondrosarcoma
- High-grade intramedullary chondrosarcoma
- Sarcoma following Pagetâs disease

Chemotherapy has no use with low-grade sarcomas:

- Well-differentiated intramedullary osteosarcoma
- Parosteal osteosarcoma
- Low-grade intramedullary chondrosarcoma
- Adamantinoma
- Chordoma

Correct Answer: Adamantinoma

3881. (3318) Q9-4171:

Which of the following is associated with multiple drug resistance in malignancies:

1) Retinoblastoma protein
3) p21
2) p53
5) Tumor necrosis factor
4) p-glycoprotein

P-glycoprotein is associated with multiple drug resistance. This complex of proteins pumps cancer treatment drugs out of the cell (efflux). This action may be accomplished by establishing an electrochemical gradient that facilitates drug efflux. This is an active area of research in which the molecular mechanisms have not been fully elucidated.

Many studies show that sarcomas have variable amounts of immunostaining for p-glycoprotein.

Correct Answer: p-glycoprotein

3882. (3319) Q9-4173:

A 10-year-old boy presents with rapidly growing soft tissue masses. The soft tissue masses mineralize over a 2-month period. He has short great toes with hallux valgus deformity. The most likely diagnosis is:

1) Polyostotic fibrous dysplasia
3) Cleidocranial dysplasia
2) Achondroplasia
5) Multifocal osteosarcoma
4) Fibrodysplasia ossificans progressiva

Clinical presentation of fibrodysplasia (myositis) ossificans progressiva:

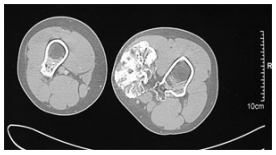
- Painful soft tissue masses (rapid progression)
  - Spontaneously
  - Minor trauma
    - Injections
    - Falls
- Location
  - Paraspinal muscles, extremities
- Aponeuroses, fascia, tendons, ligaments, voluntary skeletal muscle
- Contractures
  - Ossification of muscle bellies results in contractures/ankylosis
    - Hips
    - Spine
- Systemic problems
  - Jaw ankylosis â unable to eat
  - Scoliosis â restrictive lung disease

Pathophysiology:

- Perivascular infiltration of B, T lymphocytes
- Progresses to pure T lymphocyte infiltration of the muscles
- Enchondral ossification occurs
  - Intense immunostaining for BMP 2/4

Correct Answer: Fibrodysplasia ossificans progressiva

3883. (3320) Q9-4175:



slide 1 **slide 2** **slide 3**

A patient presents with a hard leg mass and pain with activity. The anteroposterior and lateral radiographs are shown in Slide 1 and Slide 2. An axial computed tomography scan is shown in Slide 3. Which of the following is the most likely inheritance pattern:

1) X-linked recessive
3) Autosomal recessive
2) X-linked dominant
5) Sporadic
4) Autosomal dominant

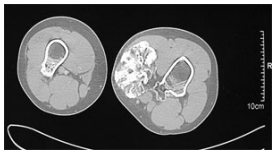
This patient has multiple hereditary exostoses. Widening of the metaphysis is characteristic of multiple hereditary exostoses. Large sessile osteochondromas arise from the metaphysis and a large osteochondroma arises from the medial metaphysis with a characteristic cartilaginous cap. The computed tomography scan shows the widening and abnormal tubulation of the bone.

No evidence of malignancy exists in this large osteochondroma. The cartilage cap is regular with no areas of bone destruction. One should also look for a soft tissue mass, which often shows areas of focal calcifications. No soft tissue masses are present in this patient.

It is important to remember that this condition is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring in this condition is approximately 10%.

Correct Answer: Autosomal dominant

3884. (3321) Q9-4176:



slide 1 **slide 2** **slide 3**

A patient presents with a hard leg mass and pain with activity. The anteroposterior and lateral radiographs are shown in Slide 1 and Slide 2. An axial computed tomography scan is shown in Slide 3. Which of the following tumor suppressor genes is most likely involved:

1) Retinoblastoma (RB)
3) P16INK4a
2) p53
5) NF1
4) EXT1

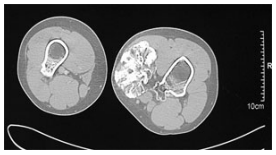
This patient has multiple hereditary exostoses. Widening of the metaphysis is characteristic of multiple hereditary exostoses. Large sessile osteochondromas arise from the metaphysis and a large osteochondroma arises from the medial metaphysis with a characteristic cartilaginous cap. The computed tomography scan shows the widening and abnormal tubulation of the bone.

No evidence of malignancy exists in this large osteochondroma. The cartilage cap is regular with no areas of bone destruction. One should also look for a soft tissue mass, which often shows areas of focal calcifications. No soft tissue masses are present in this patient.

It is important to remember that this condition is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring in this condition is approximately 10%.

Correct Answer: EXT1

3885. (3322) Q9-4177:



slide 1 **slide 2** **slide 3**

A patient presents with a hard leg mass and pain with activity. The anteroposterior and lateral radiographs are shown in Slide 1 and Slide 2. An axial computed tomography scan is shown in Slide 3. Which of the following would be the most appropriate treatment:

1) Simple excision
3) Preoperative chemotherapy and wide resection
2) Wide resection of the distal femur
5) Above-knee amputation
4) Wide resection and external beam irradiation

This patient has multiple hereditary exostoses. Widening of the metaphysis is characteristic of multiple hereditary exostoses. Large sessile osteochondromas arise from the metaphysis and a large osteochondroma arises from the medial metaphysis with a characteristic cartilaginous cap. The computed tomography scan shows the widening and abnormal tubulation of the bone.

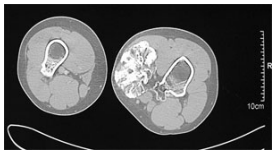
No evidence of malignancy exists in this large osteochondroma. The cartilage cap is regular with no areas of bone destruction. One should also look for a soft tissue mass, which often shows areas of focal calcifications. No soft tissue masses are present in this patient.

It is important to remember that this condition is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring in this condition is approximately 10%.

When patients are symptomatic, simple excision of the osteochondroma is all that is necessary.

Correct Answer: Simple excision

3886. (3323) Q9-4178:



slide 1 **slide 2** **slide 3**

A patient presents with a hard leg mass and pain with activity. The anteroposterior and lateral radiographs are shown in Slide 1 and Slide 2. An axial computed tomography scan is shown in Slide 3. The risk of malignancy in this condition is approximately:

1) No risk of malignancy exists.
3) 25%
2) 5% to 10%
5) 100%
4) 50%

This patient has multiple hereditary exostoses. Widening of the metaphysis is characteristic of multiple hereditary exostoses. Large sessile osteochondromas arise from the metaphysis and a large osteochondroma arises from the medial metaphysis with a characteristic cartilaginous cap. The computed tomography scan shows the widening and abnormal tubulation of the bone.

No evidence of malignancy exists in this large osteochondroma. The cartilage cap is regular with no areas of bone destruction. One should also look for a soft tissue mass, which often shows areas of focal calcifications. No soft tissue masses are present in this patient.

It is important to remember that this condition is autosomal dominant. The putative tumor suppressive gene mutation is EXT1, EXT2. The risk of low-grade chondrosarcoma occurring in this condition is approximately 10%.

When patients are symptomatic, simple excision of the osteochondroma is all that is necessary.

Correct Answer: 5% to 10%

3887. (3324) Q9-4179:

Which of the following statements is true concerning total knee replacement in patients with pigmented villonodular synovitis (PVNS) of the knee:

1) Aseptic loosening secondary to recurrent disease is common.
3) Postoperative stiffness is unlikely to occur.
2) Recurrence rates are higher than in patients treated with synovectomy alone.
5) Recurrence rates are low.
4) Postoperative results are acceptable with good knee and functional scores.

Total knee replacement is successful in patients who have PVNS. The results are equal to total knee arthroplasty in patients in the general population and patients who have focal or inactive PVNS. Loosening and recurrence are potential complications in a patient who has active diffuse PVNS and undergoes total knee replacement.

Important points to remember:

- Interval to arthroplasty, average 8 years (5 months to 23 years)
- Nine patients had 19 prior procedures
- Six patients had 14 prior recurrences
- Results (11 patients with active, diffuse disease, average age 59 years):
    - 7/11 intact functioning knees at 11 years
    - 2/7 patients required manipulation
    - 3/11 required revision for aseptic loosening
        - Loosening was not secondary to recurrent PVNS
    - 2/11 recurrence
        - One patient required above-knee amputation

Correct Answer: Postoperative results are acceptable with good knee and functional scores.

3888. (3325) Q9-4181:

Which of the following statements is true concerning pigmented villonodular synovitis (PVNS) of the hip:

1) Bone and cartilage destruction occurs less commonly than in PVNS of the knee.
3) Femoral neck and acetabular cysts and erosions are uncommon.
2) Joint effusions are rare.
5) T1- and T2-weighted magnetic resonance imaging sequences often show high signal areas with prominent signal intensification.
4) Delay in diagnosis is common.

PVNS of the hip is difficult to diagnosis, with a long interval between the beginning of symptoms and diagnosis. Important points to remember include:

- Hip involved in 15% of PVNS cases
- Long interval from symptoms to diagnosis
- Hip effusion is very common
- Patients present with severe hip pain and limitation of motion
- Nonâweight bearing cysts in >90%
- Joint space narrowing in more than two-thirds
- Femoral neck erosions in about one-third
- Bone and joint destruction is more common in PVNS of the hip compared to the knee
- Femoral neck and acetabular cysts are common

Correct Answer: Delay in diagnosis is common.

3889. (3326) Q9-4182:

Which of the following statements is true concerning pigmented villonodular synovitis (PVNS) of the hip:

1) Bone and cartilage destruction occurs more commonly than in PVNS of the knee.
3) Femoral neck and acetabular cysts and erosions are uncommon.
2) Joint effusions are rare.
5) T1- and T2-weighted magnetic resonance imaging sequences often show high signal areas with prominent signal intensification.
4) Interval between symptoms and diagnosis is short.

PVNS of the hip is difficult to diagnosis, with a long interval between the beginning of symptoms and diagnosis. Important points to remember include:

- Hip involved in 15% of PVNS cases
- Long interval from symptoms to diagnosis
- Hip effusion is very common
- Patients present with severe hip pain and limitation of motion
- Nonâweight bearing cysts in >90%
- Joint space narrowing in more than two-thirds
- Femoral neck erosions in about one-third
- Bone and joint destruction is more common in PVNS of the hip compared to the knee
- Femoral neck and acetabular cysts are common

Correct Answer: Bone and cartilage destruction occurs more commonly than in PVNS of the knee.

3890. (3366) Q9-4276:

Which of the following is the most likely cytotoxic effect of external beam irradiation when treating malignancies:

1) Damage to microvasculature
3) Depletion of cellular nutrients
2) Damage to large feeder vessels
5) Hyperthermic effect
4) Creation of free radicals

External beam irradiation creates free radicals. The free radicals damage the DNA. When the DNA cannot be repaired, cell death occurs.

The dose of irradiation is measured in grays or centigrays. A gray is a measure of the dose absorbed â 1 Gy equals 1 J/kg.

One should remember the typical dose for delivered for certain tumors:

Correct Answer: Creation of free radicals

3891. (3367) Q9-4277:

Which of the following radiation doses is most commonly used in the treatment of metastatic bone disease:

1) 800 cGy, single fraction
3) 5040 cGy, 25 fractions
2) 3000 cGy, 10 fractions
5) 6600 cGy, 33 fractions
4) 6300 cGy, 35 fractions

External beam irradiation is commonly used for the treatment of metastatic bone disease. Pain control is achieved in 70% to 80% of patients (total pain relief in about 30%). Bone destruction is at least halted temporarily.

The common dosing regimens used for metastatic bone disease are:

- 3000 cGy in 10 fractions
- 2000 cGy in five fractions
- 800 cGy in a single fraction

Correct Answer: 3000 cGy, 10 fractions

3892. (3368) Q9-4278:

Which of the following radiation doses is most commonly used to control heterotopic ossification:

1) 800 cGy
3) 3000 cGy
2) 2000 cGy
5) 5200 cGy
4) 4500 cGy

External beam irradiation creates free radicals. The free radicals damage the DNA. When the DNA cannot be repaired, cell death occurs.

The dose of irradiation is measured in grays or centigrays. A gray is a measure of the dose absorbed â 1 Gy equals 1 J/kg.

One should remember the typical dose for delivered for certain tumors/conditions:

When external beam irradiation is used to control heterotopic ossification, the radiation is delivered within 48 hours.

Correct Answer: 800 cGy

3893. (3369) Q9-4280:

Which of the following is the most significant effect of adjuvant external beam irradiation in the treatment of soft tissue sarcomas:

1) Improved disease-free survival
3) Improved disease-free survival and local control
2) Improved local control
5) Decreased local control, decreased disease-free survival
4) Improved local control, decreased disease-free survival

External beam irradiation when combined with wide surgical resection significantly decreased the risk of local recurrence in the treatment of soft tissue sarcomas. The use of preoperative or postoperative external beam irradiation does not affect disease survival.Correct Answer: Improved local control

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3894. (3370) Q9-4281:

Which of the following is a late effect of external beam irradiation when used to treat a soft tissue sarcoma:

1) Delayed wound healing
3) Fatigue
2) Desquamation
5) Stress fractures
4) Hyperpigmentation

Preoperative radiation is commonly used in the treatment of soft tissue sarcomas. A frequently used regimen is 5040 cGy in 25 fractions (Monday to Friday, 180 cGy fractions daily for 5 weeks). The early effects such as radiation dermatitis are allowed to subside and, typically, at 2 to 4 weeks, the tumor is resected. Delayed wound healing is a significant problem; it occurs in up to 30% to 50% of patients. Many centers combine surgical resection with flap coverage to minimize the risk of wound dehiscence and infection.

Early side effects of treatment:

- Radiation dermatitis
- Fatigue
- Delayed wound healing

Late side effects of treatment:

- Stress fractures
- Postirradiation sarcomas
- Osteonecrosis
- Fibrosis/edema
- Neuropathy

Correct Answer: Stress fractures

3895. (3371) Q9-4282:

Which of the following is an early effect of external beam irradiation when used as adjuvant therapy in the treatment of soft tissue sarcomas:

1) Stress fractures
3) Postirradiation sarcoma
2) Osteonecrosis
5) Fibrosis
4) Delayed wound healing

Preoperative radiation is commonly used in the treatment of soft tissue sarcomas. A frequently used regimen is 5040 cGy in 25 fractions (Monday to Friday, 180 cGy fractions daily for 5 weeks). The early effects such as radiation dermatitis are allowed to subside and, typically, at 2 to 4 weeks, the tumor is resected. Delayed wound healing is a significant problem; it occurs in up to 30% to 50% of patients. Many centers combine surgical resection with flap coverage to minimize the risk of wound dehiscence and infection.

Early side effects of treatment:

- Radiation dermatitis
- Fatigue
- Delayed wound healing

Late side effects of treatment:

- Stress fractures
- Postirradiation sarcomas
- Osteonecrosis
- Fibrosis/edema
- Neuropathy

Correct Answer: Delayed wound healing

3896. (3372) Q9-4284:

External beam irradiation is an effective modality for all of the following malignancies except:

1) Ewingâs tumor
3) Osteosarcoma
2) Lymphoma
5) Solitary myeloma of bone
4) Multiple myeloma

External beam irradiation can be effective for several malignancies such as:

- Ewingâs tumor
- Lymphoma
- Myeloma
- Metastatic bone disease
- Soft tissue sarcomas

Correct Answer: Osteosarcoma

3897. (3373) Q9-4285:

Which of the following bone malignancies can be effectively managed with external beam irradiation:

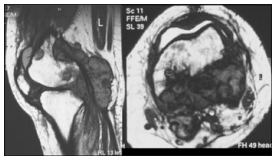
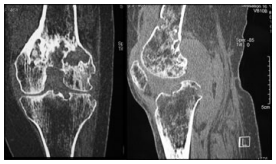
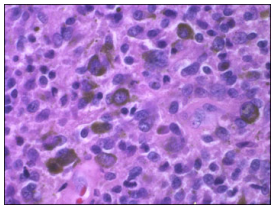
1) Osteosarcoma
3) Lymphoma
2) Chondrosarcoma
5) Malignant fibrous histiocytoma
4) Periosteal osteosarcoma

External beam irradiation can be effective for several malignancies such as:

- Ewingâs tumor
- Lymphoma
- Myeloma
- Metastatic bone disease
- Soft tissue sarcomas

Correct Answer: Lymphoma

3898. (3374) Q9-4286:

slide 1 **slide 2** **slide 3** **slide 4**

A 55-year-old woman has a 15-year history of chronic knee pain. Her plain radiographs are shown in Slide 1. Axial and sagittal T1-weighted magnetic resonance scans are shown in Slide 2. A coronal and sagittal computed tomography reconstruction is shown in Slide 3 and a biopsy in Slide 4. The most likely diagnosis is:

1) Synovial sarcoma
3) Rheumatoid arthritis
2) Epithelioid sarcoma
5) Septic arthritis
4) Pigmented villonodular synovitis

This patient has pigmented villonodular synovitis (PVNS). Patients often present with a long history of knee pain and recurrent atraumatic effusions.

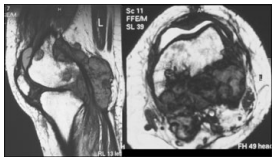
The plain radiographs show large lucent areas on both sides of the knee joint. The lateral radiograph shows a large posterior erosion. The computed tomography reconstructions show large areas on bone lysis and erosions. Notice the prominent erosions on both sides of the joint. The magnetic resonance image shows large low signal masses and major areas of erosion.

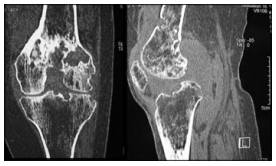
The biopsy slide shows the typical histologic features of PVNS. Note that the macrophages have ingested hemosiderin pigment giving them a characteristic granular brown appearance.

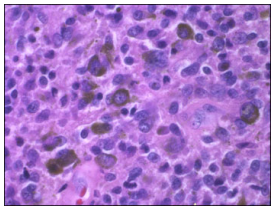
Treatment for this patient is synovectomy and total knee replacement. The amount of bone and cartilage destruction is prominent; therefore, synovectomy alone is not sufficient.

Correct Answer: Pigmented villonodular synovitis

3899. (3375) Q9-4287:







slide 1 **slide 2** **slide 3** **slide 4**

A 55-year-old woman has a 15-year history of chronic knee pain. Her plain radiographs are shown in Slide 1. Axial and sagittal T1-weighted magnetic resonance scans are shown in Slide 2. A coronal and sagittal computed tomography reconstruction is shown in Slide 3 and a biopsy in Slide 4. Which of the following is the most likely recommended treatment:

1) Arthroscopic debridement and short-term antibiotics
3) Synovectomy and total knee replacement
2) Preoperative radiation and wide resection
5) Open debridement and long-term antibiotics
4) Arthroscopic debridement and long-term antibiotics

This patient has pigmented villonodular synovitis (PVNS). Patients often present with a long history of knee pain and recurrent atraumatic effusions.

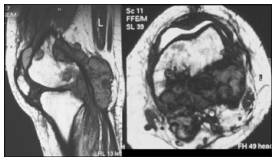
The plain radiographs show large lucent areas on both sides of the knee joint. The lateral radiograph shows a large posterior erosion. The computed tomography reconstructions show large areas on bone lysis and erosions. Notice the prominent erosions on both sides of the joint. The magnetic resonance image shows large low signal masses and major areas of erosion.

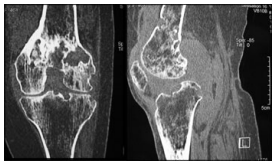
The biopsy slide shows the typical histologic features of PVNS. Note that the macrophages have ingested hemosiderin pigment giving them a characteristic granular brown appearance.

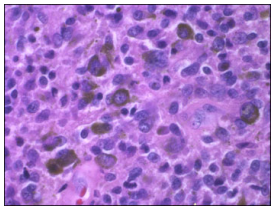
Treatment for this patient is synovectomy and total knee replacement. The amount of bone and cartilage destruction is prominent; therefore, synovectomy alone is not sufficient.

Correct Answer: Synovectomy and total knee replacement

3900. (3376) Q9-4288:







slide 1 **slide 2** **slide 3** **slide 4**

A 55-year-old woman has a 15-year history of chronic knee pain. Her plain radiographs are shown in Slide 1. Axial and sagittal T1-weighted magnetic resonance scans are shown in Slide 2. A coronal and sagittal computed tomography reconstruction is shown in Slide 3 and a biopsy in Slide 4. The most likely etiology of this condition is:

1) Systemic inflammatory
3) Infectious
2) Reactive
5) Malignant neoplasm
4) Benign neoplasm

This patient has pigmented villonodular synovitis (PVNS). Patients often present with a long history of knee pain and recurrent atraumatic effusions.

The plain radiographs show large lucent areas on both sides of the knee joint. The lateral radiograph shows a large posterior erosion. The computed tomography reconstructions show large areas on bone lysis and erosions. Notice the prominent erosions on both sides of the joint. The magnetic resonance image shows large low signal masses and major areas of erosion.

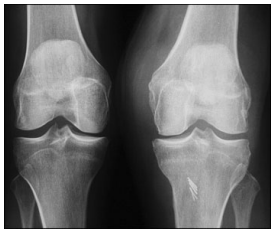
The biopsy slide shows the typical histologic features of PVNS. Note that the macrophages have ingested hemosiderin pigment giving them a characteristic granular brown appearance.

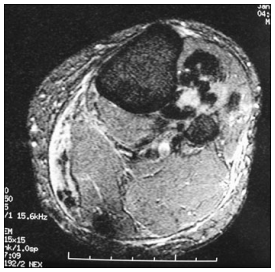
Treatment for this patient is synovectomy and total knee replacement. The amount of bone and cartilage destruction is prominent; therefore, synovectomy alone is not sufficient.

This condition is most likely a benign reactive condition rather than a true neoplasm.

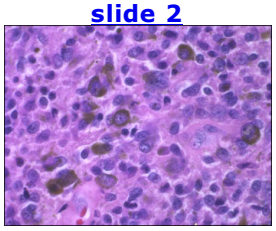
Correct Answer: Reactive

3901. (3377) Q9-4289:





slide 1 slide 2 slide 3 slide 4



slide 5 slide 6

A patient presents with increasing knee pain over a 2-year period. The anteroposterior and lateral radiographs are shown in Slide 1 and Slide 2. A computed tomography scan is shown in Slide 3 and axial T2-weighted magnetic resonance images in Slide 4 and Slide 5. A biopsy is shown in Slide 6. The most likely diagnosis is:

1) Synovial chondromatosis
3) Rheumatoid arthritis
2) Pigmented villonodular synovitis
5) Tuberculosis
4) Gout

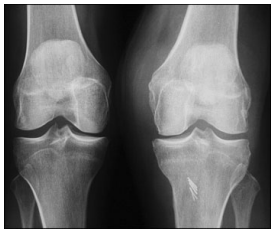
This patient has pigmented villonodular synovitis. Patients often present with a long history of knee pain and recurrent atraumatic effusions.

The plain radiographs are often fairly normal in cases involving the knee. The lateral radiograph may show subtle erosion. The computed tomography scan shows erosions on both sides of the proximal tibiofibular joint. The axial magnetic resonance images show the characteristic large low-signal masses.

Slide 6 shows the typical histologic features of pigmented villonodular synovitis. Note that the macrophages have ingested hemosiderin pigment, giving them a characteristic granular appearance.

Correct Answer: Pigmented villonodular synovitis

3902. (3378) Q9-4291:



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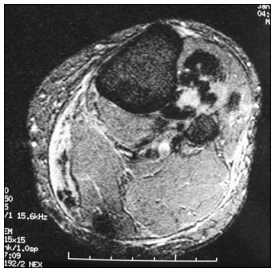

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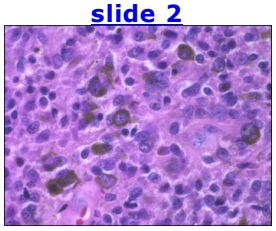


slide 6

A patient presents with increasing knee pain over a 2-year period. The anteroposterior and lateral radiographs are shown in Slide 1 and Slide 2. A computed tomography scan is shown in Slide 3 and axial T2-weighted magnetic resonance images in Slide 4 and Slide 5. A biopsy is shown in Slide 6. Which of the following best describes this condition:

1) Benign neoplasm
3) Systemic inflammatory
2) Malignant neoplasm
5) Infectious
4) Reactive condition

This patient has pigmented villonodular synovitis. Patients often present with a long history of knee pain and recurrent atraumatic effusions.

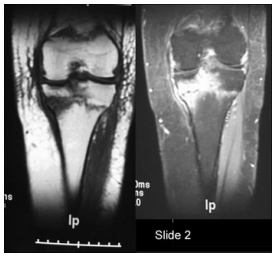
The plain radiographs are often fairly normal in cases involving the knee. The lateral radiograph may show subtle erosion. The computed tomography scan shows erosions on both sides of the proximal tibiofibular joint. The axial magnetic resonance images show the characteristic large low-signal masses.

Slide 6 shows the typical histologic features of pigmented villonodular synovitis. Note that the macrophages have ingested hemosiderin pigment, giving them a characteristic granular appearance.

The treatment for patients with patient has pigmented villonodular synovitis is synovectomy. For this patient, a reasonable method may be anterior arthroscopic synovectomy and open posterior synovectomy or open anterior and posterior synovectomy.

Correct Answer: Reactive condition

3903. (3379) Q9-4292:



slide 1 **slide 2**

A 68-year-old woman presents with severe knee pain with ambulation for a 4-month period. Her history is significant for resection and postoperative external beam irradiation for a synovial sarcoma 15 years previously. The anteroposterior and lateral radiographs are shown in Slide 1. The coronal T1- and T2-weighted magnetic resonance images (MRIs) are shown in Slide 2. The most likely diagnosis is:

1) Metastatic synovial sarcoma
3) Osteomyelitis
2) Postirradiation sarcoma
5) Osteonecrosis
4) Stress fracture

A number of late effects may occur following external beam irradiation for soft tissue sarcomas: postirradiation sarcomas, stress fractures, vascular insufficiency, chronic wound problems, and osteonecrosis.

This patient has a stress fracture of the proximal medial tibia. One can see the lucent area and the condensation of bone in a linear fashion.

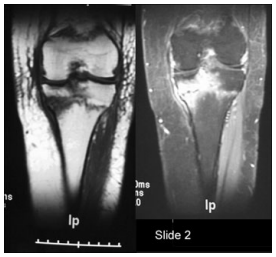
The MRI shows very characteristic features:

- T1-weighted coronal â low signal linear fracture line traversing the tibia
- T2-weighted coronal â high signal crossing the medial tibia with a low signal linear area (condensation of bone seen in stress fractures)

Nonoperative treatment would be the initial management with protected weight bearing. These stress fractures may require a long time to heal and the nonunion rate is high with nonoperative and operative treatment. If the fracture does not heal in a 3- to 6-month period with nonoperative measures, then rigid internal fixation with or without bone grafting should be considered.

Correct Answer: Stress fracture

3904. (3380) Q9-4294:



slide 1 **slide 2**

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1) Metastatic disease
3) Bone insufficiency
2) Vascular insufficiency
5) Osteonecrosis
4) Osteoarthritis

A number of late effects may occur following external beam irradiation for soft tissue sarcomas: postirradiation sarcomas, stress fractures, vascular insufficiency, chronic wound problems, and osteonecrosis.

This patient has a stress fracture of the proximal medial tibia. One can see the lucent area and the condensation of bone in a linear fashion.

The MRI shows very characteristic features:

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Correct Answer: Bone insufficiency

3905. (3441) Q9-4366:

Which of the following is the most likely cytotoxic effect of external beam irradiation when treating malignancies:

1) Damage to microvasculature
3) Depletion of cellular nutrients
2) Damage to large feeder vessels
5) Hyperthermic effect
4) Creation of free radicals

External beam irradiation creates free radicals. The free radicals damage the DNA. When the DNA cannot be repaired, cell death occurs.

The dose of irradiation is measured in grays or centigrays. A gray is a measure of the dose absorbed â 1 Gy equals 1 J/kg.

One should remember the typical dose for delivered for certain tumors:

Correct Answer: Creation of free radicals

3906. (3442) Q9-4367:

Which of the following doses is most commonly used as postoperative adjuvant therapy following wide resection of a soft tissue sarcoma:

1) 800 cGy
3) 3000 cGy
2) 2000 cGy
5) 6600 cGy
4) 4500 cGy

External beam irradiation creates free radicals. The free radicals damage the DNA. When the DNA cannot be repaired, cell death occurs.

The dose of irradiation is measured in grays or centigrays. A gray is a measure of the dose absorbed â 1 Gy equals 1 J/kg.

One should remember the typical dose for delivered for certain tumors:

Correct Answer: 6600 cGy

3907. (3444) Q9-4370:

Which of the following describes the method of cell toxicity for most chemotherapy drugs:

1) Interferes with microtubule function
3) Interrupts adenosine triphosphate-dependent cell membrane pumps
2) Directly damages DNA
5) Induces programmed cell death
4) Depletes cellular building blocks

Chemotherapy drugs can be classified into three broad classes:

- Directly damages DNA
  - Alkylating agents, platinum compounds, anthracyclines
  - Epipodophyllotoxins
- Depletes cellular building blocks
  - Antifolates, cytidine analogs
  - 5-fluoropyrimidines
- Interferes with microtubule function
  - Vinca alkaloids, taxanes

Meyers and Gorlick state that, in general, chemotherapy drugs induce programmed cell death (apoptosis).

Correct Answer: Induces programmed cell death

3908. (3457) Q9-4388:

External beam irradiation is effective in the management of which of the following bone malignancies:

1) Osteosarcoma
3) Malignant fibrous histiocytoma
2) Chondrosarcoma
5) Periosteal osteosarcoma
4) Ewingâs tumor

External beam irradiation can be effective for several malignancies such as:

- Ewingâs tumor
- Lymphoma
- Myeloma
- Metastatic bone disease
- Soft tissue sarcomas

Correct Answer: Ewingâs tumor

3909. (3485) Q9-4425:

Which of the following genetic abnormalities occur in fibrodysplasia ossificans progressiva (FOP):

1) CBAF1/RUNX2
3) Missense mutation ACVR1
2) Activating mutation of FGFR3
5) Collagen type X mutation
4) Activating missense mutation GNAS (alpha subunit)

Fibrodysplasia ossificans progressiva is a rare heritable disorder with the following key features:

- Recurrent episodes of soft tissue swelling that leads to heterotopic ossification
- Great toe malformations
- Incidence of 1 in 2,000,000
- Autosomal dominant

Genetic findings:

- Mutation â activin A type 1 receptor gene (ACVR1)
    - Missense mutation in glycine-serine (GS) activation domain

The other conditions refer to:

- CBAF1/RUNX2 â cleidocranial dysplasia
- Activating mutation of FGFR3 â achondroplasia
- Activating missense mutation GNAS (alpha subunit) â fibrous dysplasia
- Collagen type X mutation â Schmidâs type metaphyseal chondrodysplasia

Correct Answer: Missense mutation ACVR1

3910. (3494) Q9-4436:

Which of the following is the major regulator of the transition from the G1 phase of the cell cycle to the S phase (synthesis and reproduction):

1) p53 protein
3) Cyclin-dependent kinase inhibitors
2) p21 protein
5) Retinoblastoma protein
4) Dihydrofolate reductase (DHFR)

During the reproductive cycle of cells, the most important transition is from G1 or G0 (resting states) to the S phase. In the S phase, synthesis of DNA and mitosis occurs. In humans, this transition point is regulated by the retinoblastoma protein.

The retinoblastoma protein is controlled by a group of regulatory proteins â cyclins (cyclin D and E kinases), cyclin-dependent kinases (CDK4, CDK6), and cyclin kinase inhibitors (p16, p21).

To begin cell synthesis, the retinoblastoma protein is phosphorylated by cyclin D and CDK4. This phosphorylation causes release of the E2F transcription factor. The E2F transcription factor signals increased transcription of a number of genes, including dihydrofolate reductase (DHFR), thymidylate synthetase (TS), thymidine kinase (TK), and ribonucleotide reductase (RR). These factors are necessary for DNA replication in the S phase.

The important point to remember is that the retinoblastoma gene (Rb1) and the retinoblastoma protein regulate the transition point from G1 to the S phase. Tumor cells cannot grow without going past this transition point.

Correct Answer: Retinoblastoma protein

3911. (3508) Q9-4460:

Which of the following statements is true concerning total knee replacement in patients with pigmented villonodular synovitis (PVNS) of the knee:

1) Aseptic loosening secondary to recurrent disease is common.
3) Postoperative stiffness is common.
2) Recurrence rates are higher than in patients treated with synovectomy alone.
5) Recurrence rates are low.
4) Postoperative results show failures in more than 50% of patients.

Total knee replacement is successful in patients who have PVNS. The results are equal to total knee arthroplasty in patients in the general population and patients who have focal PVNS. Loosening and recurrence are potential complications in a patient who has active diffuse PVNS and undergoes total knee replacement.

Important points to remember:

- Interval to arthroplasty, average 8 years (5 months to 23 years)
- Nine patients had 19 prior procedures
- Six patients had 14 prior recurrences
- Results (11 patients with active, diffuse disease, average age 59 years):
    - 7/11 intact functioning knees at 11 years
    - 2/7 patients required manipulation
    - 3/11 required revision for aseptic loosening
        - Loosening was not secondary to recurrent PVNS
    - 2/11 recurrence
        - One patient required above-knee amputation

Correct Answer: Postoperative stiffness is common.

3912. (3724) Q9-7504:

Which of the following fusion proteins has the best prognosis in patients with Ewingâs tumor:

1) EWS-ERG
3) EWS-ETV1
2) EWS-FLI1
5) EWS-FEV
4) EWS-ETV4

Ewingâs tumor is characterized by a balanced translocation â t(11;22). A chimeric protein is formed called the fusion product.

The most common fusion product is EWS-FLI1 (found in 85%). EWA-FLI1 has the best prognosis.

The other fusion products found in Ewingâs tumor include:

- EWS-ERG
- EWS-ETV1
- EWS-ETV4
- EWS-FEV

Correct Answer: EWS-FLI1

3913. (3725) Q9-7505:

Which of the following gene fusion product occurs in Ewingâs tumor:

1) SYT-SSX1
3) EWS-FLI1
2) SYT-SSX2
5) EWS-ATF1
4) TLS(FUS)-CHOP

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- EWS-ERG
- EWS-ETV1
- EWS-ETV4
- EWS-FEV

The other responses address:

- Synovial sarcoma
  - o SYT-SSX1
  - o SYT-SSX2
- Myxoid liposarcoma â TLS (FUS)-CHOP
- Clear cell sarcoma

Correct Answer: EWS-FLI1

3914. (3726) Q9-7506:

Which of the following gene fusion products occurs in patients with synovial sarcoma:

1) EWS-FLI1
3) EWS-ATF1
2) TLS (FUS) â CHOP
5) EWS-ERG
4) SYT-SSX1

Synovial sarcoma has a characteristic translocation â t(X;18). The gene fusion product is SYT-SSX1 and SYT-SSX2.

The other responses address:

- Ewings sarcoma
  - Â Â Â Â Â oÂ Â EWS-FLI1
  - Â Â Â Â Â oÂ Â EWS-ERG
- Myxoid liposarcoma â TLS (FUS)-CHOP
- Clear cell sarcoma â EWS-ATF1

Correct Answer: SYT-SSX1

3915. (3727) Q9-7507:

Which of the following gene fusion products occurs in patients with clear cell sarcoma:

1) EWS-FLI1
3) EWS-ATF1
2) TLS (FUS)-CHOP
5) SYT-SSX2
4) SYT-SSX1

Clear cell sarcoma has a balanced translocation â t(12;22). The gene fusion product is TLS (FUS)-CHOP.

The other responses address:

- Synovial sarcoma

  Â Â Â Â Â oÂ Â Â SYT-SSX1
  Â Â Â Â Â oÂ Â SYT-SSX2
- Ewings tumor â EWS-FLI1

Correct Answer: TLS (FUS)-CHOP

3916. (3743) Q9-7523:

Which of the following is the best approximate survival of patients with breast cancer following metastasis to bone:

1) 6 months
3) 24-36 months
2) 12 months
5) 10 years
4) 5 years

The average survival of patients with breast cancer is between 24-36 months.

The approximate survival for patients with the other common tumors is:

- Lung, kidney, melanoma: 6 months
- Prostate: 48 months

Correct Answer: 24-36 months

3917. (3744) Q9-7524:

Which of the following is released by metastatic breast cancer cells in bone and activates osteoclast precursor cells:

1) Receptor activator of nuclear factor kappa B ligand (RANKL)
3) Metalloproteinases (MMPs)
2) Osteoprotegerin (OPG)
5) Parathyroid hormone-related protein (PTHrP)
4) Tumor necrosis factor (TNF)

The metastatic breast cancer cells release parathyroid hormone-related protein (PTHrP), which stimulates osteoblasts to release the receptor activator of nuclear factor kappa B ligand (RANKL). RANKL attaches to the receptor activator of nuclear factor kappa B (RANK) receptor on the osteoclast precursor cells and initiates osteoclast activation.

The other responses refer to:

- MMPs â Released by tumor cells to cause dissolution of the basement membrane and matrices
- TNF â Released in rheumatoid arthritis, resulting in synovial proliferation and articular cartilage damage
- OPG â A competitive decoy inhibitor that binds to the RANKL and prevents attachment to the RANK receptor on the osteoclast precursor cells; OPG prevents osteoclast activation and bone resorption

Correct Answer: Parathyroid hormone-related protein (PTHrP)

3918. (3745) Q9-7525:

Which of the following is released by breast cancer cells and causes direct activation of osteoclasts:

1) Parathyroid hormone-related protein (PTHrP)
3) Interleukin-8 (IL-8)
2) Osteoprotegerin (OPG)
5) MIP-1α
4) Endothelin-1

Interleukin-8 (IL-8) is released by metastatic breast cancer cells and can cause direct activation of osteoclasts. This direct activation is independent of the RANKL activation of the RANK receptor.

The other responses refer to:

- PTHrP â Released by metastatic breast cancer cells and causes activation of the osteoclast via signaling to the osteoblast for release of the RANKL
- OPG â A competitive decoy inhibitor that binds to the RANKL and prevents attachment to the RANK
- receptor on the osteoclast precursor cells; OPG prevents osteoclast activation and bone resorption
- Endothelin-1 â Causes bone formation in metastatic prostate cancer to bone
-
- MIP-1α â Produced by multiple myeloma cells and causes osteoclast activation

Correct Answer: Interleukin-8 (IL-8)

3919. (4065) Q9-7526:

Which of the following causes bone formation in metastatic prostate cancer:

1) Parathyroid hormone-related protein (PTHrP)
3) Endothelin-1
2) Interleukin-8 (IL-8)
5) Osteoprotegerin (OPG)
4) MIP-1α

Endothelin-1 is postulated to be responsible for the osteoblastic metastases in prostate cancer.

The other responses refer to:

- PTHrP â Released by metastatic breast cancer cells and causes activation of the osteoclast via signaling to the osteoblast for release of the RANKL
- OPG â A competitive decoy inhibitor that binds to the RANKL and prevents attachment to the RANK receptor on the osteoclast precursor cells; OPG prevents osteoclast activation and bone resorption
- MIP-1α â Produced by multiple myeloma cells and causes osteoclast activation
- IL-8 â Causes direct activation of osteoclasts and bone resorption

Correct Answer: Endothelin-1

3920. (3746) Q9-7527:

Which of the following is the best approximation of survival after bone metastases in lung cancer:

1) 6 months
3) 36 months
2) 24 months
5) 60 months
4) 48 months

The average survival of patients with lung cancer following bone metastases is approximately 6 months.

Correct Answer: 6 months

3921. (3747) Q9-7528:

Which of the following carcinomas has a propensity to metastasize to distal sites such as the hands and feet:

1) Breast cancer
3) Lung cancer
2) Kidney cancer
5) Prostate cancer
4) Thyroid cancer

Lung cancer has a predilection to metastasize to distal sites such as the hands and feet.

Correct Answer: Lung cancer

3922. (3748) Q9-7529:

Which of the following directly promotes tumor cell metastasis:

1) NM-23
3) Receptor activator of nuclear factor kappa B ligand (RANKL)
2) MKK4
5) RKIP
4) Activated RAS

Activated RAS begins the Raf-MEK-ERK-MAPK pathway, which causes tumor cell growth and metastasis.

Tumor suppressor genes can inhibit the metastatic process:
- NM-23 â phosphorylates the Ksr protein
- RKIP â competitive inhibitor of MEK
- MKK4 â causes stress-induced apoptosis

RANKL binds to the RANK receptor and activates the osteoclast precursor cells.

Correct Answer: Activated RAS

3923. (3749) Q9-7530:

Which of the following directly promotes tumor cell metastasis:

1) Receptor activator of nuclear factor kappa B ligand (RANKL)
3) Osteoprotegerin (OPG)
2) Receptor activator of nuclear factor kappa B (RANK)
5) Activated RAS
4) Tumor necrosis factor (TNF)

Activated RAS begins the Raf-MEK-ERK-MAPK pathway, which causes tumor cell growth and metastasis.

RANKL binds to the RANK receptor and activates the osteoclast precursor cells. Osteoprotegerin is a competitive inhibitor of the RANKL (binds it and promotes the RANKL attaching to the RANK receptor).

Tumor necrosis factor is an inflammatory factor causing destruction of the articular cartilage.

Correct Answer: Activated RAS

3924. (3750) Q9-7531:

Which of the following causes metastatic cells to localize to bone (homing in mechanism):

1) NM-23
3) RKIP
2) MKK4
5) PTHrP
4) CXCL12

CXCL12 is called chemokine ligand 12 (stromal cell-derived factor 1). This factor is thought to be responsible for metastatic tumor cells to localize to bone. Chemostasis occurs as chemokine receptor 4 is activated on the tumor cells.

Tumor suppressor genes can inhibit the metastatic process:

- NM-23 â phosphorylates the Ksr protein
- RKIP â competitive inhibitor of MEK
- MKK4 â causes stress-induced apoptosis

Parathyroid hormone-related protein (PTHrP) is released by breast cancer metastatic cells. The same receptors for parathyroid hormone (PTH) are activated.

- PTH/PTHrP causes osteoclast activation and bone resorption.

Correct Answer: CXCL12

3925. (3751) Q9-7532:

Which of the following is important for cell attachment in the metastatic process:

1) Receptor activator of nuclear factor kappa B ligand (RANKL)
3) Integrins
2) Receptor activator of nuclear factor kappa B (RANK)
5) CXCL12
4) Metalloproteinases (MMPs)

The integrins are the most common of all the cell adhesion molecules. Adhesion molecules allow tumor cells to attach to the basement membrane for eventual penetration. The integrins also play an important role in tumor cells attaching to bone.

Examples:

- Alpha âv-beta 3 (ȧuβ3) â breast cancer cells attaching to type I collagen
- Alpha âv-beta 1 (ȧuβ1) â osteoclast binding to bone

Correct Answer: Integrins

3926. (3752) Q9-7533:

Which of the following factors is important for invasion of the basement membrane in the metastatic process:

1) Integrins
3) Parathyroid hormone-related protein (PTHrP)
2) Metalloproteinases (MMPs)
5) Receptor activator of nuclear factor kappa B ligand (RANKL)
4) CXCL12

Metalloproteinases (MMPs) are a group of enzymes that break down matrixes and membranes. The collagenases are in the group of MMPs. The MMPs are important for penetration of the basement membrane.

The other responses refer to:

- Integrins â Adhesive proteins for cell attachment
- PTHrP â Causes osteoclast activation and bone resorption
- CXCL12 â Causes homing of tumor cells to bone
- RANKL â Causes activation of osteoclast precursor cells to osteoclasts

Correct Answer: Metalloproteinases (MMPs)

3927. (3753) Q9-7534:

Which of the following factors is important for angiogenesis in the metastatic process:

1) Vascular endothelial growth factor (VEGF)
3) CXCL12
2) Parathyroid hormone-related protein (PTHrP)
5) Receptor activator of nuclear factor kappa B ligand (RANKL)
4) Integrins

Vascular endothelial growth factor is an important stimulant for new blood vessel formation. The matrix is first broken down by matrix degrading enzymes such as plasminogen activator and metalloproteinases.

The other responses refer to:

- Integrins â Adhesive protein for cell attachment
- PTHrP â Causes osteoclast activation and bone resorption
- CXCL12 â Causes homing of tumor cells to bone
- RANKL â Causes activation of osteoclast precursor cells to osteoclasts

Correct Answer: Vascular endothelial growth factor (VEGF)

3928. (3855) Q9-7638:

Which of the following diagnoses is most consistent with a magnetic resonance image that shows high peripheral signal intensity and low central intensity on T2-weighted images and low signal on T1-weighted images:

1) Nodular fasciitis
3) Malignant fibrous histiocytoma
2) Schwannoma
5) Epitheloid sarcoma
4) Synovial sarcoma

Schwannomas have characteristic findings on magnetic resonance scans. These benign nerve sheath tumors sometimes have a characteristic signal appearance on T2-weighted images, which includes a high peripheral signal intensity and low central intensity on T2-weighted images.

This can also be called a target sign.

Correct Answer: Schwannoma

3929. (3856) Q9-7639:

Which of the following soft tissue tumors may have a split-fat sign on T1-weighted images around the tumor:

1) Nodular fasciitis
3) Synovial sarcoma
2) Malignant fibrous histiocytoma
5) Schwannoma
4) Epitheloid sarcoma

The split-fat sign on T1-weighted images occurs when a thin rim of fat is present around a mass. Although this finding is nonspecific, it commonly occurs in schwannomas.

Correct Answer: Schwannoma

3930. (3857) Q9-7640:

Which of the following describes the histologic appearance of a schwannoma:

1) Herringbone pattern of fibroblasts and collagen
3) Storiform pattern of spindle cells and giant cells
2) Areas of cellular twisted nuclei and separate myxoid areas
5) Nests of cells with clear cytoplasm and areas of pigment deposition
4) Biphasic â Spindle cells and epithelial cells

Schwannomas have a characteristic histologic appearance:

- Antoni A: Cellular areas with twisted nuclei (the cells are Schwann cells)
- Antoni B: Myxoid areas
- Verocay bodies are also seen and are characteristic of schwannomas
    - Palisading nuclei in a parallel arrangement

The other responses refer to:

- Fibrosarcoma: Herringbone pattern
- Malignant fibrous histiocytoma: Storiform pattern
- Synovial sarcoma: Biphasic â epithelial cells and spindle cells
- Clear cell sarcoma: Nests of cells with clear cytoplasm and pigment deposition

Correct Answer: Areas of cellular twisted nuclei and separate myxoid areas

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3931. (3858) Q9-7641:

Which of the following immunochemical stains is typically positive in schwannomas:

1) Keratin
3) Myoglobin
2) Desmin
5) Epithelial membrane antigen
4) S-100

Schwannomas have a characteristic histologic appearance:

- Antoni A: Cellular areas with twisted nuclei (the cells are Schwann cells)
- Antoni B: Myxoid areas
- Verocay bodies are also seen and are characteristic of schwannomas
    - Palisading nuclei in a parallel arrangement

The other responses refer to:

- Keratin: Stains epithelial cells (positive in synovial sarcoma and epitheloid sarcoma)
- Desmin: Positive in rhabdomyosarcoma
- Myoglobin: Positive in rhabdomyosarcoma
- Epithelial membrane antigen: Positive in synovial sarcoma

Correct Answer: S-100

3932. (3859) Q9-7642:

Which of the following is true concerning the surgical treatment of a schwannoma:

1) Radical margin is necessary
3) Marginal margin with sacrifice of nerve fibers as necessary
2) Wide margin is necessary
5) Intralesional or marginal margin with care to preserve all nerve fibers
4) Intralesional margin with sacrifice of nerve fibers as necessary

Schwannomas can be treated with observation or excision (intralesional or marginal). Every effort should be made to preserve all the nerve fibers.

Correct Answer: Intralesional or marginal margin with care to preserve all nerve fibers

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3933. (3860) Q9-7643:

Patients with plexiform neurofibromas most likely have an abnormality in which of the following genes:

1) Runt related transcription factor 2 (Runx2)
3) Neurofibromatosis (NF)-1
2) Lipoprotein receptor-related protein 5 (LRP5)
5) Retinoblastoma gene (Rb-1)
4) NF-2

Patients with plexiform neurofibromas often have neurofibromatosis. The genetic abnormality is a mutation in the NF-1 gene.

The other responses refer to:

- Runx2: Crucial for bone formation, defect results in cleidocranial dysplasia
- LRP5: Deficiencies result in osteoporosis
- NF-2: Mutations result in acoustic neuromas
- Rb-1: Tumor-suppressor gene, defects make patients more prone to osteosarcoma and retinoblastoma

Correct Answer: Neurofibromatosis (NF)-1

3934. (3861) Q9-7644:

Which of the following imaging features is characteristic of a neurofibroma:

1) Mineralized at the periphery and lucent in the center
3) Rim enhancement with contrast imaging
2) Fat suppression
5) Signal dropout on gradient echo sequences
4) T2-weighted peripheral high signal, low central signal

Neurofibromas often have a characteristic âtarget signâ on T2-weighted images. The target sign occurs because of peripheral high signal on T2-weighted images and low signal in the center.

The other responses refer to:

- Heterotopic ossification: Mineralized at the periphery and lucent in the center
- Lipomas: Show complete fat suppression
- Fluid-filled structures: Rim enhancement with contrast imaging
- Pigmented villonodular synovitis: Signal dropout on gradient echo sequences

Correct Answer: T2-weighted peripheral high signal, low central signal

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3935. (3862) Q9-7645:

Which of the following describes the microscopic appearance of a neurofibroma:

1) Distinct hyoid and cellular areas
3) Spindle- and stellate-shaped cells in a mucoid matrix
2) Verocay bodies
5) Random bundles of coarse collagen and cells with wavy nuclei
4) Disorganized admixture of fibrous tissue and regenerative nerve sprouts

Neurofibromas have a characteristic appearance:

- Random bundles of collagen
- Wavy nuclei
- Myxoid matrix

Other lesions that must be distinguished from neurofibromas include:

- Schwannoma: Myxoid and cellular areas
  - Antoni A: Cellular areas
  - Antoni B: Myxoid areas
  - Verocay bodies: Parallel arrangement of nuclei
- Myxoma: Spindle- and stellate-shaped cells in a mucoid matrix
- Neuroma: Disorganized admixture of fibrous tissue and regenerative nerve sprouts

Correct Answer: Random bundles of coarse collagen and cells with wavy nuclei

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3936. (3863) Q9-7646:

A patient has the following findings: axillary skin freckling, cafÃ© au lait spots, multiple subcutaneous nodules, and Lisch nodules. Which of the following genetic abnormalities is most likely:

1) Runt related transcription factor 2 (Runx2)
3) Retinoblastoma gene (Rb-1)
2) Lipoprotein receptor-related protein 5 (LRP5)
5) NF-2
4) Neurofibromatosis (NF)-1

The described phenotype is most consistent with neurofibromatosis. The genetic abnormality is a mutation in NF-1.

The other responses refer to:

- Runx2: Crucial for bone formation, defect results in cleidocranial dysplasia
- LRP5: Deficiencies result in osteoporosis
- NF-2: Mutations result in acoustic neuromas
- Rb-1: Tumor-suppressor gene, defects make patients more prone to osteosarcoma and retinoblastoma

Correct Answer: Neurofibromatosis (NF)-1

3937. (3864) Q9-7647:

Which of the following conditions has the highest risk of malignant change:

1) Neurofibroma
3) Plexiform neurofibroma
2) Schwannoma
5) Perineurioma
4) Myxoma within a nerve

Patients with plexiform neurofibromas often have neurofibromatosis. The risk of malignant change is approximately 5% to 10%. Plexiform neurofibroma has the greatest chance of malignant degeneration.

Correct Answer: Plexiform neurofibroma

3938. (2736) Q10-3233:

Which of the following molecules play(s) an important role influencing both embryonic bone formation and fracture healing:

1) Indian hedgehog (ihh) and core-binding factor 1 (cbf1)
3) Platelet-derived growth factor (PDGF)
2) Transforming growth factor beta (TGF-B)
5) Vascular endothelial growth factor (VEGF)
4) Interleukin-1 (IL-1)

Important concepts to remember in regard to signaling proteins include:

- Indian hedgehog (ihh) and core-binding factor 1 (cbf1) influence both embryonic bone formation and fracture healing.
- Vascular endothelial growth factor (VEGF) plays a role in cartilage hypertrophy at the growth plate and during fracture healing.
- Transforming growth factor beta (TGF-B) and platelet-derived growth factor (PDGF) are found in the early fracture hematoma and these factors modulate cell proliferation and differentiation.
- Bone morphogenetic protein and interleukin 1 and 6 are expressed during cartilage formation.

Correct Answer: Indian hedgehog (ihh) and core-binding factor 1 (cbf1)

3939. (2737) Q10-3234:

Which of the following factors are present in the hematoma following a fracture and play a role in modulating cell proliferation and differentiation:

1) Indian hedgehog (ihh) and core-binding factor 1 (cbf1)
3) Interleukin-1 (IL-1)
2) Transforming growth factor beta (TGF-B) and platelet-derived growth factor (PDGF)
5) Vascular endothelial growth factor (VEGF)
4) Interleukin-6 (IL-6)

Important concepts to remember in regard to signaling proteins include:

- Indian hedgehog (ihh) and core-binding factor 1 (cbf1) influence both embryonic bone formation and fracture healing.
- Vascular endothelial growth factor (VEGF) plays a role in cartilage hypertrophy at the growth plate and during fracture healing.
- Transforming growth factor beta (TGF-B) and platelet-derived growth factor (PDGF) are found in the early fracture hematoma and these factors modulate cell proliferation and differentiation.
- Bone morphogenetic protein and interleukin 1 and 6 are expressed during cartilage formation.

Correct Answer: Transforming growth factor beta (TGF-B) and platelet-derived growth factor (PDGF)

3940. (2738) Q10-3235:

Which of the following factors play(s) an important role in cartilage hypertrophy during growth plate development and ossification in fracture healing:

1) Indian hedgehog (ihh) and core-binding factor 1 (cbf1)
3) Interleukin-1 (IL-1)
2) Transforming growth factor beta (TGF-B) and platelet-derived growth factor (PDGF)
5) Vascular endothelial growth factor (VEGF)
4) Interleukin-6 (IL-6)

Important concepts to remember in regard to signaling proteins include:

- Indian hedgehog (ihh) and core-binding factor 1 (cbf1) influence both embryonic bone formation and fracture healing.
- Vascular endothelial growth factor (VEGF) plays a role in cartilage hypertrophy at the growth plate and during fracture healing.
- Transforming growth factor beta (TGF-B) and platelet-derived growth factor (PDGF) are found in the early fracture hematoma and these factors modulate cell proliferation and differentiation.
- Bone morphogenetic protein and interleukin 1 and 6 are expressed during cartilage formation.

Correct Answer: Vascular endothelial growth factor (VEGF)

3941. (2739) Q10-3236:

All of the following are important to achieve primary osteonal healing during plate fixation except:

1) Anatomic reduction
3) Adequate vascular supply
2) Rigid fixation
5) Very low strain levels
4) Moderate to high strain levels

In primary osteonal bond healing, osteoclasts cut channels across the bone contact sites and blood vessels and osteoblasts fill in the gap with new bone.

To achieve osteonal healing, there must be an anatomic reduction with rigid fixation. An adequate blood supply must be present and the amount of motion at the fracture must be very small to none (very low strain levels).

Moderate to high strain levels occur if there is motion at the osteosynthesis site. This motion can result from poor fixation (lack of rigidity) or excessive loading during the healing period. High strain levels in the gap favor the formation of granulation tissue rather than bone.

Correct Answer: Moderate to high strain levels

3942. (2740) Q10-3237:

All of the following factors will increase the rigidity of an external fixator *except*:

1) Increased individual pin diameter
3) Increased bone to rod distance
2) Increased pin number
5) Separating half pins by 45Â°
4) Increased pin group separation

Many factors influence the rigidity of an external fixator. Factors that increase the rigidity of the system include:

- Increased pin diameter
- Increased pin number
- Decreased bone to rod distance
- Increased pin group separation
- Separating half pins by 45Â°

Increasing the bone to rod distance will decrease the rigidity of the system.

The fracture gap is also important. The gap should be minimized so that there is excellent bone apposition.

Correct Answer: Increased bone to rod distance

3943. (2741) Q10-3238:

Which of the following graft types has both osteoinductive and osteoconductive properties:

1) Autogenous bone marrow
3) Bone morphogenetic protein-2
2) Coral-based hydroxyapatite bone graft substitute
5) Cancellous bone graft
4) Bone morphogenetic protein-7 (recombinant)

Grafting materials may have osteoconductive and/or osteoinductive, and osteoprogenitor cells.

Cancellous bone graft and vascularized bone grafts are the only materials that have significant osteoconductive, osteoinductive, and osteoprogenitor cells.

Several materials are mainly osteoinductive. Remember the definition of osteoinductive and osteoconductive properties:

- Osteoinductive factors: molecules that have the capability of inducing osteoblastic precursors to differentiate into mature bone forming cells.
  -Osteoinductive factors (without significant osteoconductive powers) include:

    Growth factors:
    BMP-2
    rhBMP-7 (OP-1)
    Demineralized bone matrix

- Osteoconduction: the ability of a porous material to provide a scaffold for new bone formation.
  -Osteoconductive materials without significant osteoinductive properties:

    Ceramics

        Coral-based hydroxyapatite graft substitutes
        Norian skeletal repair system (Norian Corporation, Cupertino, Calif)
        Calcium sulfate pellets (Osteoset, Wright Medical Technology, Arlington, Tenn)

- Bone marrow has the potential of supplying osteoprogenitor cells but has little osteoinductive or osteoconductive properties.

Correct Answer: Cancellous bone graft

3944. (2742) Q10-3239:

Which of the following materials has mainly osteoconductive properties with little or no osteoinductive ability:

1) Autogenous bone marrow
3) Bone morphogenetic protein-2
2) Coral-based hydroxyapatite bone graft substitute
5) Cancellous bone graft
4) Bone morphogenetic protein-7 (recombinant)

Grafting materials may have osteoconductive and/or osteoinductive, and osteoprogenitor cells.

Cancellous bone graft and vascularized bone grafts are the only materials that have significant osteoconductive, osteoinductive, and osteoprogenitor cells.

Several materials are mainly osteoinductive. Remember the definition of osteoinductive and osteoconductive properties:

- Osteoinductive factors: molecules that have the capability of inducing osteoblastic precursors to differentiate into mature bone forming cells.
  -Osteoinductive factors (without significant osteoconductive powers) include:

    Growth factors:
    BMP-2
    rhBMP-7 (OP-1)
    Demineralized bone matrix

- Osteoconduction: the ability of a porous material to provide a scaffold for new bone formation.
  -Osteoconductive materials without significant osteoinductive properties:

    Ceramics

        Coral-based hydroxyapatite graft substitutes
        Norian skeletal repair system (Norian Corporation, Cupertino, Calif)
        Calcium sulfate pellets (Osteoset, Wright Medical Technology, Arlington, Tenn)

- Bone marrow has the potential of supplying osteoprogenitor cells but has little osteoinductive or osteoconductive properties.

Correct Answer: Coral-based hydroxyapatite bone graft substitute

3945. (4056) Q10-3240:

Which of the following materials has mainly osteoinductive properties with little or no osteoconductive ability:

1) Autogenous bone marrow
3) Calcium sulfate crystals
2) Coral-based hydroxyapatite bone graft substitute
5) Cancellous bone graft
4) Bone morphogenetic protein-7 (recombinant)

Grafting materials may have osteoconductive and/or osteoinductive, and osteoprogenitor cells.

Cancellous bone graft and vascularized bone grafts are the only materials that have significant osteoconductive, osteoinductive, and osteoprogenitor cells.

Several materials are mainly osteoinductive. Remember the definition of osteoinductive and osteoconductive properties:

- Osteoinductive factors: molecules that have the capability of inducing osteoblastic precursors to differentiate into mature bone forming cells.
  -Osteoinductive factors (without significant osteoconductive powers) include:

    Growth factors:
    BMP-2
    rhBMP-7 (OP-1)
    Demineralized bone matrix

- Osteoconduction: the ability of a porous material to provide a scaffold for new bone formation.
  -Osteoconductive materials without significant osteoinductive properties:

    Ceramics

        Coral-based hydroxyapatite graft substitutes
        Norian skeletal repair system (Norian Corporation, Cupertino, Calif)
        Calcium sulfate pellets (Osteoset, Wright Medical Technology, Arlington, Tenn)

- Bone marrow has the potential of supplying osteoprogenitor cells but has little osteoinductive or osteoconductive properties.

Correct Answer: Bone morphogenetic protein-7 (recombinant)

3946. (2743) Q10-3241:

When electrically stimulated, bone tissue shows new bone formation at which of the following sites:

1) The positive electrode
3) The battery pack
2) The anode
5) The cathode
4) Bone marrow

Bone growth occurs at the negative electrode. The anode is a positive electrode, and the battery functions as the anode. Bone growth in bone marrow is not induced by electric stimulation.Correct Answer: The cathode

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3947. (2744) Q10-3242:

Which of the following statements is true about electric bone physiology:

1) Bone tissue has no electric potential because it is predominantly made up of calcium and collagen.
3) Bone tissue has an electric potential that is dependent on the viability of the bone tissue.
2) Bone tissue has an electric potential that is dependent on the charge on the pain nerves.
5) Collagen contorts the electromagnetic field generated by muscles to produce a bone magnetic field.
4) Bone is electromagnetic by nature because calcium has a strong ferromagnetic effect.

Bone tissue has an electric potential that is dependent on its viability. Calcium and collagen have not been reported to be related to this field. Pain nerves do not generate the potential in bone. There is no bone magnetic field and collagen.Correct Answer: Bone tissue has an electric potential that is dependent on the viability of the bone tissue.

3948. (2745) Q10-3243:

All of the following are modalities of electrical stimulation used in practice *except*:

1) Direct current electric stimulation (DCES)
3) Pulsed electric magnetic stimulation (PEMF)
2) Capacitively coupled electric energy (CCES)
5) Combined magnetic fields (CMF)
4) Pulsed micromagnetic stimulation (PMMF)

There is no description of a pulsed micromagnetic stimulation (PMMF) device in scientific literature.

All of the other choices are currently in practice.

Correct Answer: Pulsed micromagnetic stimulation (PMMF)

3949. (2746) Q10-3244:

Which of the following is the major disadvantage of using pulsed electric magnetic stimulation (PEMF):

1) PEMF must be implanted, thereby increasing the chance of infection.
3) PEMF can cause necrosis of surrounding tissue.
2) PEMF causes nausea and vomiting by stimulating the chemo trigger zone.
5) There are no disadvantages.
4) PEMF is dependent on patient compliance.

Patient compliance is a drawback to the use of PEMF. A direct current electric stimulation device must be implanted, whereas PEMF is usually part of a brace. None of the devices has been described to cause nausea.Correct Answer: PEMF is dependent on patient compliance.

3950. (2747) Q10-3245:

Which of the following statements is true:

1) Electromagnetic stimulation has not been shown clinically effective.
3) Pulsed electric magnetic stimulation (PEMF) is the only FDA-approved modality as an adjunct to spinal fusion.
2) Pending trials in primates, electromagnetic stimulation is not yet a U.S. Food and Drug Adminstration (FDA)-approved modality.
5) The FDA has banned electromagnetic stimulation because it causes serious cardiac arrhythmias.
4) Electromagnetic stimulation appears to be effective in spinal fusion, but it is not widely used.

Electromagnetic stimulation is FDA approved and has been shown to be clinically effective in more than one study.

Although effective, it is not commonly used during routine fusions.

Correct Answer: Electromagnetic stimulation appears to be effective in spinal fusion, but it is not widely used.

3951. (2748) Q10-3246:

In terms of the osteoinductive capacity of different demineralized bone matrix (DBM) products, which of the following statements is true:

1) Because the bone morphogenetic protein (BMP) content of DBM is regulated by the U.S. Food and Drug Administration (FDA), osteoinductive capacity is equal among DBM products.
3) The osteoinductive capacity of DBM is not affected by the method of sterilization.
2) The osteoinductive capacity of DBM is unaffected by the age of the donor because the calcium is removed during processing.
5) The osteoinductive capacity of DBM is affected by age of the donor and method of sterilization.
4) Overall efficacy is equal because each batch of DBM is made from a pool of donors that minimizes variation.

The osteoinductive capacity of DBM can be affected by the method of processing, storage, sterilization, and the age of the donor. Although calcium is removed during the demineralization process, this does not affect the osteoinductivity of DBM. The FDA requires that each batch of DBM be obtained from a single human donor, not from a pool of donors. The content of BMP in DBM is not regulated by the FDA.Correct Answer: The osteoinductive capacity of DBM is affected by age of the donor and method of sterilization.

3952. (2749) Q10-3247:

Demineralized bone matrix (DBM) regenerates bone through which of the following mechanisms:

1) Osteogenesis
3) Osteoinduction
2) Osteoconduction
5) Osteoconduction and osteoinduction
4) Osteogenesis and osteoinduction

Demineralized bone matrix acts as an osteoconductive and possible osteoinductive material. The osteoinductive capability of DBM is attributed to the bone morphogenetic proteins (BMPs) present in the extracellular matrix of the donor bone, which are preserved during the demineralization process. However, the amount of BMP within DBM is smaller than the supraphysiologic amounts provided with recombinant human BMP. Osteogenesis refers to a bone graft that supplies live osteoblasts or stem cells that can differentiate into osteoblasts. Only autogenous bone grafts and bone marrow aspirates are considered osteogenic.Correct Answer: Osteoconduction and osteoinduction

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3953. (2750) Q10-3248:

Demineralized bone matrix (DBM) is indicated for which of the following situations:

1) Unstable, contained skeletal defects
3) As a supplement when an adequate autogenous bone graft is also used
2) Stable, contained skeletal defects
5) Any circumstance where autogenous bone grafts are recommended
4) Fractures requiring additional structural support after internal fixation

Because DBM does not provide structural support, recommended uses include stable contained skeletal defects, such as bone cysts and cavities. Although many authors have reported healing rates similar to autogenous bone grafting historical controls, no randomized studies offer a true comparison of DBM to autogenous bone grafting. Additional uses of DBM include augmentation of autogenous bone grafts when the supply of graft is limited or the defect is large, but it is not used when there is adequate autogenous bone graft.Correct Answer: Stable, contained skeletal defects

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3954. (2751) Q10-3249:

Demineralized bone matrix (DBM) contains which of the following substances:

1) Collagen
3) Bone growth factors such as bone morphogenetic protein (BMP)
2) Noncollagenous proteins
5) Collagen, Noncollagenous proteins, and bone growth factors such as bone morphogenetic protein (BMP)
4) Collagen and bone growth factors such as bone morphogenetic protein (BMP)

Demineralized bone matrix (DBM) is formed by means of acid extraction from cadaver bone, leaving noncollagenous proteins, collagen, and a small amount of bone growth factors, such as BMP.Correct Answer: Collagen, Noncollagenous proteins, and bone growth factors such as bone morphogenetic protein (BMP)

3955. (2752) Q10-3250:

When reviewing the marketing claims of various demineralized bone matrix (DBM) products, which of the following statements is true:

1) Claims are accurate because they are monitored by the U.S. Food and Drug Administration.
3) Claims are usually inaccurate because studies show no difference among various companiesâ DBM.
2) Claims are usually based on published, peer-reviewed research.
5) Claims are true if they refer to DBM alone, rather than its combination with other bone graft substitutes.
4) Claims should be interpreted with caution.

The claims made by various companies and tissue banks concerning their DBM should be interpreted with caution. Although there are variations in processing, there are usually little comparative scientific data available to support companiesâ claims that their processing method offers unique advantages and superior performance over other products. In the United States, DBM is classified as a minimally manipulated tissue for transplantation. Historically, there has been little regulatory control over the claims made by tissue processing facilities.Correct Answer: Claims should be interpreted with caution.

3956. (2811) Q10-3312:

Calcium phosphate is a bone graft substitute that can be best described as:

1) Osteogenic
3) Osteoinductive
2) Osteoconductive
5) None of the above
4) Both osteoconductive and osteoinductive

Calcium phosphate is an osteoconductive bone graft substitute. Over time, calcium phosphate undergoes osteoclastic resorption followed by the invasion of small blood vessels that become surrounded by circumferential lamellae of new bone. Calcium phosphate does not have any osteogenic or osteoinductive capacity.Correct Answer: Osteoconductive

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3957. (2812) Q10-3313:

Compared with cancellous bone and other bone graft substitutes, the compressive strength of calcium phosphate is:

1) Less than cancellous bone and less than other bone graft substitutes
3) Less than cancellous bone but greater than other bone graft substitutes
2) Greater than cancellous bone but less than other bone graft substitutes
5) Equal to cancellous bone and other bone graft substitutes
4) Greater than both cancellous bone and other bone graft substitutes

Compared with cancellous bone grafts and other bone graft substitutes, calcium phosphate has a high compressive strength. For example, once Norian SRS (Skeletal Repair System, Synthes, Paoli, Pa) hardens, approximately 12 hours after injection, its compressive strength is approximately 55 MPa. This is roughly 4 to 10 times greater than the average compressive strength of cancellous bone.Correct Answer: Greater than both cancellous bone and other bone graft substitutes

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3958. (2813) Q10-3314:

Calcium phosphate provides which of the following advantages in fracture repair:

1) Improved rate of fracture healing
3) Supports internal fixation and resists redisplacement of fracture fragments
2) Eliminates the need for use of metallic internal fixation implants
5) Supports internal fixation and resists redisplacement of fracture fragments and may permit earlier weight bearing or functional use
4) May permit earlier weight bearing or functional use

Numerous biomechanical studies have shown that calcium phosphate increases internal fixation strength and stiffness, and resists redisplacement of reduced fracture fragments.

Calcium phosphate is intended to be used in conjunction with some form of internal fixation. In a biomechanical study of simulated distal radius fractures, calcium phosphate was found to be insufficient to withstand the physiologic loads associated with wrist flexion and extension unless supplemental K-wire fixation was added.

Several clinical studies have reported good success when fracture fixation was augmented with calcium phosphate. This allowed early weight bearing and functional use of the extremity with good results.

Calcium phosphate is an osteoconductive bone graft substitute. It does not increase the speed of healing. However, preclinical studies have shown its effectiveness as a carrier for rhBMP-2. This provided gradual release of rhBMP-2 and accelerated bone repair.

Correct Answer: Supports internal fixation and resists redisplacement of fracture fragments and may permit earlier weight bearing or functional use

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3959. (2814) Q10-3315:

When calcium phospate (eg. Norian SRS (Skeletal Repair System, Synthes, Paoli, Pa) hardens in situ and cures by crystallization, it forms what structure that is similar to that found in the mineral phase of bone:

1) Tri-calcium phosphate
3) Calcium
2) Dahllite
5) Collagen
4) Mineralized cartilage

Calcium phosphate hardens in situ and cures by a crystallization reaction to form dahllite, a carbonated apatite that is similar to that found in the mineral phase of bone.Correct Answer: Dahllite

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3960. (2815) Q10-3316:

When extrusion of calcium phosphate into the joint occurs following its percutaneous injection in intra-articular fractures, which of the following complications has been reported:

1) Joint ankylosis
3) Infection
2) Rapid, progressive degenerative changes
5) None of the above
4) Inflammation with surrounding soft tissue pain

Although intra-articular extrusion of calcium phosphate should be avoided, when it has occurred there have been no reported adverse sequelae.

Painful soft tissue response was reported in 4 of 20 patients who underwent curettage of enchondromas and injection with Norian SRS (Skeletal Repair System, Synthes, Paoli, Pa). This prompted the authors to discontinue this method of enchondroma treatment and recommend that the cement be "sealed" by placing curetted bone over the exposed surface of the cement.

Correct Answer: None of the above

3961. (2918) Q10-3419:

What are the desirable osteogenic cells to exploit from bone marrow aspirates:

1) Differentiated mesenchymal cells and granulocytes
3) Granulocytes and fibroblasts
2) Undifferentiated mesenchymal cells and osteoprogenitor cells
5) Granulocytes and erythrocytes
4) Erythrocytes and osteoprogenitor cells

Undifferentiated mesenchymal stem cells have the ability to proceed down any cell lineage and osteoprogenitor cells are prepared to proceed down bone-forming lineages. Both cell lines are crucial in the production of new bone.Correct Answer: Undifferentiated mesenchymal cells and osteoprogenitor cells

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3962. (2919) Q10-3420:

Bone marrow aspirates are generally acquired in what incremental volumes to maximize efficient yield:

1) 1 cc
3) 3 cc
2) 2 cc
5) 5 cc
4) 4 cc

Harvesting aspirates in no greater than 2 mL aliquots leads to the most efficient yield. Beyond this, one begins to draw venous backflow of blood.Correct Answer: 2 cc

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3963. (2920) Q10-3421:

All of the following factors have been implicated in effecting cell composition of marrow-derived cells *except*:

1) Donor age
3) Donor ethnicity
2) Osteoporosis
5) Donor gender
4) Aspiration volume

Wide variability in marrow-derived cells was shown among individual patients and was attributed to differences in donor age, gender, aspiration volume, and osteoporosis. Although donor ethnicity has been suggested, no studies have established this association.Correct Answer: Donor ethnicity

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3964. (2921) Q10-3422:

All of the following are mechanisms that have been investigated in preparation and concentration of bone marrow aspirate except:

1) Ionic separation
3) Centrifugation
2) Vortex
5) Sedimentation
4) Diffusion chamber

Marrow osteoprogenitor cells are aspirated from the iliac crest and injected into the desired surgical site to effectively stimulate osteogenesis. Before application, the aspirate can be prepared and concentrated through a variety of methods including vortex, centrifugation, sedimentation, and diffusion chamber. Ionic separation has not been used as a mechanism to prepare or concentrate bone marrow.Correct Answer: Ionic separation

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3965. (2922) Q10-3423:

Which of the following has been shown to be a significant difficulty associated with osteoprogenitor cell cloning:

1) Cloned cells produce mature osseous tissue later than mixed marrow cell aspirate.
3) Cloned cells often contain contaminants that significantly increase post-implantation morbidity.
2) Using cells obtained from cloning for spinal fusion does not increase fusion rates above those of mixed marrow cells.
5) Cloned osteoprogenitor cells have a tendency to terminally differentiate resulting in a reduced concentration of cells capable of osteogenesis
4) Cloned osteoprogenitor cells do not produce mature osseous tissue to a greater degree than mixed marrow cell aspirate.

Cloned osteoprogenitor cells have been shown to produce mature osseous tissue earlier and to a greater degree than mixed marrow cell aspirate. Fusion rates are significantly increased with cloned osteoprogenitor cells as compared to mixed marrow cells.

The difficulty with the osteoprogenitor cloning technique, however, is that the cells have a tendency to terminally differentiate as they are clonally expanded, resulting in a decreased concentration of cells capable of osteogenesis. Moreover, establishing cells as belonging to an osteoprogenitor lineage can be challenging.

Cloned cells have not been shown to contain contaminants or increase morbidity.

Correct Answer: Cloned osteoprogenitor cells have a tendency to terminally differentiate resulting in a reduced concentration of cells capable of osteogenesis

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3966. (2923) Q10-3424:

Clinically used structural allografts may be:

1) Osteoconductive
3) Osteogenic
2) Osteoinductive
5) Osteoconductive, Osteoinductive and Osteogenic
4) Osteoconductive and Osteoinductive

Allograft osteogenic characteristics are lost during tissue processing for transplantation.

- Allograft contains structural collagen for new bone deposition (osteoconduction).
- Allograft is not osteogenic.

Correct Answer: Osteoconductive

3967. (2924) Q10-3425:

Fresh frozen allograft is prepared by:

1) Taking from the cadaver for direct transplantation
3) Treating with acid to extract a composite of collagen, noncollagenous proteins, and a low concentration of growth factors
2) Washing in an antibiotic solution, cooled to -70Âº C, and dehydrated through a vacuum process to reduce the water content to less than 5%
5) Washing in an antibiotic solution, treated with acid, and cooled to -70Âº C
4) Washing in an antibiotic solution and cooled to -70Âº C

Fresh frozen allograft is frozen after its harvest; after being washed in an antibiotic solution, it is cooled to -70Âº C.

- Direct transplantation describes fresh preparation.
- Freeze-dried allograft undergoes a process called lyophilization, where the specimen is washed, cooled, and dehydrated.
- Acid treatment describes the process of demineralization.
- Fresh frozen specimens are not treated with acid.

Correct Answer: Washing in an antibiotic solution and cooled to -70Âº C

3968. (2925) Q10-3426:

While discussing surgical options regarding her upcoming spinal fusion, a patient asks about the risks of human immunodeficiency virus (HIV) transmission in allograft use. Which of the following is the best response:

1) There has never been a reported case of HIV transmission from allograft.
3) The estimated risk of HIV transmission from allograft is approximately 1 in 1 trillion.
2) HIV cannot survive in tissue once it is removed from the host.
5) The estimated risk of HIV transmission from allograft is approximately 1 in 100.
4) The estimated risk of HIV transmission from allograft is approximately 1 in 1 million.

Fresh frozen allograft is frozen after its harvest; after being washed in an antibiotic solution, it is cooled to -70Âº C.

- HIV has been transmitted to a reported 4 cases of fresh frozen allograft.
- HIV can survive in blood and tissue specimens outside the body.
- Allograft carries the risk of HIV transmission in less than 1 per 1 million uses.

Correct Answer: The estimated risk of HIV transmission from allograft is approximately 1 in 1 million.

3969. (4057) Q10-3427:

Which of the following statements is true regarding posterior allograft applications:

1) In the adult population, allograft fusions perform better under conditions of tension rather than compression.
3) Allograft is far superior to autograft in posterior applications for spinal fusion.
2) Allograft fusions have shown success in pediatric patients with scoliosis.
5) Radiographic studies examining side-by-side comparison of autograft and allograft show similar size fusion masses.
4) In comparison to allograft, procedures using autograft have less blood loss and operating time.

The pediatric population has been the exception to the poor results of allograft in posterior application.

- Allograft performs better under conditions of compression than tension.
- Autograft is superior to allograft in posterior applications.
- Procedures using allograft have less blood loss and shorter operating time.
- Radiographic studies of side-by-side comparisons show smaller allograft fusion masses.

Correct Answer: Allograft fusions have shown success in pediatric patients with scoliosis.

3970. (2926) Q10-3428:

Which statement is not true concerning anterior applications of allograft in the spine:

1) Smoking is a risk factor for developing nonunion in allograft fusions
3) Self-assessment questionnaires have shown greater improvement in function, less pain, and less medication usage in patients receiving an allograft.
2) In the adult population, allograft fusions perform better under conditions of compression rather than tension.
5) Allograft fusion masses are larger than autograft fusion masses.
4) Allograft has better success than autograft in multilevel fusion studies.

Many studies have shown higher fusion rates for autograft vs. allograft in multilevel studies.

- Smoking is a major risk factor for nonunion.
- Allograft fuses better under compression forces than tension forces.
- Questionnaires reveal that patients who receive an allograft show improvement in function, less pain, and less medication usage.

Correct Answer: Allograft has better success than autograft in multilevel fusion studies.

3971. (2927) Q10-3429:

Calcium sulfate is a bone graft substitute that can be best described as:

1) Osteogenic
3) Osteoinductive
2) Osteoconductive
5) Both osteoinductive and osteogenic
4) Both osteoconductive and osteogenic

Most authors describe calcium sulfate as an osteoconductive bone graft substitute. Calcium sulfate is relatively rapidly resorbed in 4 to 12 weeks and provides only short-term three-dimensional framework to support osteoconduction.Correct Answer: Osteoconductive

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3972. (2928) Q10-3430:

The compressive strength of calcium sulfate bone graft substitute pellets is:

1) Greater than calcium phosphate
3) Similar to cancellous bone
2) Much less than cancellous bone
5) Not as great as its bending strength
4) Not as great as its tensile strength

Calcium sulfate has a compressive strength equal to or greater than cancellous bone grafts. The compressive strength of calcium sulfate is much less than the compressive strength of calcium phosphate, which once cured has a compressive strength of approximately 55 MPa (roughly four to 10 times greater than the average compressive strength of cancellous bone). Because of its low compressive strength, calcium sulfate is indicated only for use in bone defects that are not intrinsic to the stability of the bone structure. Calcium sulfate has no appreciable tensile, bending, or torsional strength.Correct Answer: Similar to cancellous bone

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3973. (2929) Q10-3431:

The addition of antibiotics to calcium sulfate bone graft substitutes can best be described as:

1) Ineffective because the antibiotics are inactivated when they become bound to the calcium sulfate
3) Less effective than debridement alone when examined in a rabbit osteomyelitis model
2) Limited because tobramycin cannot be used with calcium sulfate
5) Effective in animal models and effective in human clinical study
4) Effective in animal models, but not effective in human clinical study

The relatively rapid resorption of calcium sulfate makes it an ideal carrier for gradual release of antibiotics. Calcium sulfate impregnated with tobramycin was found to be more effective at eradication of infection than either debridement alone or treatment with intramuscular antibiotics in a rabbit osteomyelitis model. In a preliminary published report of its use in patients with infected long bone defects and nonunions, successful eradication of infection was achieved in 23 of 25 patients.Correct Answer: Effective in animal models and effective in human clinical study

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3974. (2930) Q10-3433:

A common complication associated with the use of calcium sulfate bone graft substitutes includes:

1) Sterile abscess
3) Serous wound drainage
2) Hypercalcemia
5) Aggressive foreign body giant cell reaction
4) Malignant transformation

Wound drainage was reported in 4% of patients in a series of 109 patients treated with calcium sulfate pellets. Researchers theorize that this serous drainage is due to the osmotic effect of the calcium sulfate and subsides with the eventual resorption of the calcium sulfate. Calcium sulfate produces little or no foreign bone giant cell reaction.Correct Answer: Serous wound drainage

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3975. (2960) Q10-3466:

Coralline hydroxyapatite is a bone graft substitute that can be best described as:

1) Osteogenic
3) Osteoinductive
2) Osteoconductive
5) None of the above
4) Both osteoconductive and osteoinductive

Coralline hydroxyapatite is an osteoconductive bone graft substitute. It has a 3-dimensional structure of interconnected porosity that mimics cancellous bone. Capillaries, perivascular tissue, and osteoprogenitor cells migrate into these porous spaces and form bone.Correct Answer: Osteoconductive

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3976. (2961) Q10-3467:

Compared with cancellous bone, the compressive strength of coralline hydroxyapatite is:

1) Greater than cancellous bone
3) Greater than cancellous bone but decreases with tissue ingrowth
2) Greater than cancellous bone and increases with tissue ingrowth
5) Similar to cancellous bone but decreases with tissue ingrowth
4) Similar to cancellous bone and increases with tissue ingrowth

The compressive strength of coralline hydroxyapatite is similar to cancellous bone. Its compressive strength increases as the tissue ingrowth is converted to mature lamellar bone.Correct Answer: Similar to cancellous bone and increases with tissue ingrowth

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3977. (2962) Q10-3468:

Pro-osteon(Interpore) bone graft substitute is produced from marine coral using a process that converts calcium carbonate into what substance:

1) Cancellous bone
3) hydroxyapatite
2) Calcium sulfate
5) Carbonic acid
4) Beta tricalcium phosphate

Coralline hydroxyapatite is produced from marine coral exoskeletons that have a regular pore structure, resembling the structure of cancellous bone. The genus *Gonipora* has a microstructure similar to that of cancellous bone, with parallel longitudinal pores of 600 Âµm, with interconnecting channels ranging from 220 Âµm to 260 Âµm. Optimal pore size and interconnectivity are important for vascular ingrowth. The coral is subjected to high pressure and heated in an aqueous phosphate solution, converting the calcium carbonate coral skeleton into hydroxyapatite [$C_{10}(PO_4)_6(OH)_2$].Correct Answer: hydroxyapatite

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3978. (2963) Q10-3469:

Which of the following statements is true concerning the use of coralline hydroxyapatite in the management of tibial plateau fractures:

1) Coralline hydroxyapatite has sufficient strength to buttress the reduction as long as patients remain non-weight bearing.
3) Coralline hydroxyapatite requires internal fixation to maintain reduction.
2) Coralline hydroxyapatite has sufficient strength to buttress the reduction even with weight bearing.
5) Coralline hydroxyapatite has little chance for bone ingrowth due to the fracture location.
4) Coralline hydroxyapatite is inferior to autogenous bone graft.

Coralline hydroxyapatite does not have sufficient mechanical strength to be used alone and internal fixation is required. In a randomized study of patients treated with either autogenous bone graft or coralline hydroxyapatite, there were no significant differences in either the radiologic or clinical assessments. Histologic analysis of human and animal biopsy specimens show bone ingrowth into the porous implant.Correct Answer: Coralline hydroxyapatite requires internal fixation to maintain reduction.

3979. (2964) Q10-3470:

What is considered the main property of coralline hydroxyapatite that makes it a successful bone graft substitute:

1) Presence of calcium phosphate for binding of osteoblasts
3) 3-dimensional interconnected pore structure
2) Presence of calcium carbonate for binding of osteoblasts
5) Presence of calcium carbonate for binding of osteocytes
4) Presence of calcium phosphate for binding of osteocytes

The 3-dimensional structure of coralline hydroxyapatite with its interconnected porosity that mimics cancellous bone is considered to be the main property that makes it a successful bone graft substitute. This scaffold allows invasion of capillaries, perivascular tissue, and osteoprogenitor cells with the subsequent formation of bone.Correct Answer: 3-dimensional interconnected pore structure

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3980. (2986) Q10-3492:

Collagen-based matrices, such as Collagraft (Zimmer, Warsaw, Ind) or Healos (DePuy Acromed, Raynham, Mass), are indicated for use in which manner?

1) In areas requiring a mechanically strong bone graft substitute
3) In conjunction with antibiotics for the treatment of osteomyelitis
2) In articular fractures with cartilage defects
5) In conjunction with demineralized bone matrix
4) In conjunction with autogenous bone marrow

Collagen-based matrices are indicated for use in conjunction with autogenous bone marrow. The collagen matrix provides an osteoconductive scaffold. Addition of autogenous bone marrow provides osteogenic cells. It is not indicated for use in osteomyelitis or in conjunction with demineralized bone matrix. The material has no mechanical strength and so must be used in conjunction with internal or external fixation. It is not indicated for the repair of intra-articular cartilage defects.Correct Answer: In conjunction with autogenous bone marrow

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3981. (2987) Q10-3493:

Contraindications for the use of collagen-based matrices include all of the following except:

1) Patients with a known hypersensitivity to bovine collagen
3) Patients with multiple severe allergies
2) Patients with a history of anaphylaxis
5) Patients with rheumatoid arthritis
4) Patients undergoing desensitization injections to meat products

Collagen-based matrices should not be used in patients with severe allergies (eg, history of anaphylaxis, history of multiple severe allergies) or known allergies to bovine collagen. It should also not be used in patients who are undergoing desensitization injections to meat products because these may contain bovine collagen. The use of xenographic collagen has raised concern of the risk that its immunogenicity may elicit a harmful immune reaction. In the collagraft clinical study, a small percentage of patients developed antibodies to type I bovine collagen, but these did not show any cross-reactivity to human collagen and did not result in dermal hypersensitivity and did not appear to affect function of the bone graft substitute.Correct Answer: Patients with rheumatoid arthritis

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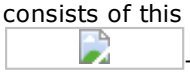
3982. (2988) Q10-3494:

Collagen-based matrices are composed of which of the following substances:

1) Porcine type I collagen
3) Bovine type I and III collagen
2) Porcine type I and III collagen
5) Recombinant human collagen proteins
4) Bovine Type I and VI collagen

Collagen-based matrices are prepared from bovine dermis. They contain primarily type I collagen (>95%) and a small amount of type III collagen (<5%). Collagraft (Zimmer, Warsaw, Ind) consists of this collagen matrix combined with biphasic calcium phosphate ceramic granules (65% hydroxyapatite and 35%  -tricalcium phosphate). Healos (DePuy Acromed, Raynham, Mass) consists of a matrix of cross-linked bovine type-I collagen fibers that are circumferentially coated with hydroxyapatite using a proprietary 360Â° accretion process. Both products are intended to be used with the addition of autogenous bone marrow.Correct Answer: Bovine type I and III collagen

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3983. (2989) Q10-3495:

In the absence of autogenous bone marrow, collagen-based matrices such as Collagraft (Zimmer, Warsaw, Ind) or Healos (DePuy Acromed, Raynham, Mass) can best be described as:

1) Osteogenic
3) Osteoinductive
2) Osteoconductive
5) Osteogenic and osteoinductive
4) Osteoconductive and osteoinductive

Collagen-based matrices act primarily as osteoconductive bone graft substitutes. The addition of autogenous bone marrow adds live osteoblasts and stem cells that are osteogenic. While the product itself is not osteoinductive, osteoinductive properties have been shown when combined with autogenous bone marrow in a rat model. Other authors question whether this combination of materials is osteoinductive.Correct Answer: Osteoconductive

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3984. (2990) Q10-3496:

When compared with autogenous bone graft in the management of acute fractures, collagraft has been shown to be:

1) Less effective than autogenous bone graft
3) As effective and with an equal morbidity to autogenous bone graft
2) As effective but with a higher risk due to allergic reactions
5) Unable to determine because of inadequate follow-up in clinical studies
4) As effective and with a lower morbidity than autogenous bone graft

Chapman and colleagues performed a prospective, randomized, multicenter study to compare autogenous bone graft to Collagraft with autogenous bone marrow in long bone fractures. Inclusion criteria were patients between 18 and 70 years old with a fracture of the ulna, radius, humerus, tibia, or femur that was being treated with internal or external fixation and bone grafting within 30 days of their initial injury. The criteria for requiring bone grafting were based on the judgment of the operating surgeon. In this study, they followed 213 patients with 249 fractures for a minimum of 24 months to monitor fracture healing and the occurrence of complications. They found no significant differences in fracture healing rates (Collagraft 98% at 24 months compared to 99% for autogenous bone graft) or complication rates. The authors concluded that for traumatic defects of long bones requiring grafting, Collagraft was justified based on its safety, effectiveness, and decreased operative time and risk from eliminating the autogenous iliac crest bone graft. Preliminary findings of this multicenter study were also published in 1991. Autogenous bone grafting is associated with a known morbidity. Younger and Chapman reported an overall major complication rate of 8.6% and a minor complication rate of 20.6%.

Major criticism of the Collagraft clinical trial is the absence of two appropriate control groups (no additional bone graft substitute, autogenous bone marrow alone). It is argued that many of these fractures may have healed without the addition of a bone graft substitute, and this may be especially true with the current emphasis for indirect fracture reduction to optimize preservation of fracture site blood supply.

Correct Answer: As effective and with a lower morbidity than autogenous bone graft

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3985. (3088) Q10-3597:

Compared with human bone, the compressive strength of tricalcium phosphate is:

1) Greater than cortical bone
3) Similar to cancellous bone
2) Greater than cancellous bone
5) Because it is a bone graft substitute, its mechanical properties cannot be compared to human bone.
4) Less than cancellous bone

The compressive strength of tricalcium phosphate is similar to that of cancellous bone. The material is resorbed relatively rapidly, weakening its compressive strength. Therefore, tricalcium phosphate is not recommended for use without internal fixation or in areas of stress intrinsic to the bone stability. Of the many bone graft substitutes, only calcium phosphate has a compressive strength that is greater than cancellous bone.

Correct Answer: Similar to cancellous bone

3986. (3089) Q10-3598:

Compared to the mineral composition of bone, tricalcium phosphate is characterized as:

1) Having a significantly greater concentration of calcium
3) Having a similar concentration of calcium and phosphate
2) Having a significantly greater concentration of phosphate
5) Having a significantly lower concentration of phosphate
4) Having a significantly lower concentration of calcium

Tricalcium phosphate [$Ca^3(PO^4)^2$] bone graft substitutes are composed of 39% calcium and 20% phosphorus by weight in a molar concentration of 1.5. This composition is similar to the mineral content of bone (35% calcium, 15% phosphorus).

Correct Answer: Having a similar concentration of calcium and phosphate

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3987. (3090) Q10-3599:

Indications for the use of tricalcium phosphate include:

1) Critical size segmental bone defects
3) Physeal fractures in children
2) Infected nonunion unions, where it can be used in combination with antibitoics
5) Defects that are not intrinsic to the stability of bone structure
4) Fractures in which mechanical stabilization cannot be obtained

The use of a tricalcium phosphate bone graft substitute is indicated for defects that are not intrinsic to the stability of the bone structure. Tricalcium phosphate does not provide sufficient mechanical support to be used without adjunctive internal or external fixation. Its use is contraindicated in segmental defects, infection, and physeal fractures.

Correct Answer: Defects that are not intrinsic to the stability of bone structure

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3988. (3091) Q10-3600:

Which of the following statements is true concerning the resorption of tricalcium phosphate in humans:

1) Occurs through an inflammatory giant cell response
3) Occurs gradually over a period of 6 to 18 months
2) Occurs rapidly within 6 weeks of placement
5) The volume of bone ingrowth usually exceeds the volume of tricalcium phosphate that is resorbed.
4) Because its composition is similar to that of bone, the rate of resorption is extremely slow and occurs only after many years.

Tricalcium phosphate undergoes resorption via dissolution and fragmentation over a period of 6 to 18 months. Resorption of tricalcium phosphate occurs by osteoclasts without an inflammatory or giant cell response. The bone volume produced is always less than the volume of the tricalcium phosphate that is resorbed.

Compared to other osteoconductive bone graft substitutes, the resorption rate of tricalcium phosphate is slower than calcium sulfate, but much more rapid than hydroxyapatite.

Correct Answer: Occurs gradually over a period of 6 to 18 months

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3989. (3435) Q10-4356:

Teriparatide (Forteo, Eli Lilly) is an injectable recombinant human parathyroid hormone (rhPTH) approved in the United States:

1) For use in the treatment of postmenopausal women with osteoporosis
3) To enhance fracture repair
2) To increase bone mass in men with primary hypogonadal osteoporosis
5) For use in the treatment of postmenopausal women with osteoporosis, to increase bone mass in men with primary hypogonadal osteoporosis, and to enhance fracture repair
4) For use in the treatment of postmenopausal women with osteoporosis, and to increase bone mass in men with primary hypogonadal osteoporosis

Teriparatide (Forteo, Eli Lilly) is an injectable rhPTH for the treatment of postmenopausal women with osteoporosis who are at risk for fracture. It is also indicated to increase bone mass in men with primary hypogonadal osteoporosis who are at high risk for fracture. Teriparatide is administered as a subcutaneous injection into the thigh or abdominal wall, once daily, at a recommended dosage of 20 mg. Because the safety and efficacy of teriparatide has not been evaluated beyond 2 years of treatment, its use for longer than 2 years is not recommended.

The use a teriparatide for enhancing fracture healing is not a current indication. There are ongoing clinical trials evaluating the effect of teriparatide on fracture healing.

Correct Answer: For use in the treatment of postmenopausal women with osteoporosis, and to increase bone mass in men with primary hypogonadal osteoporosis

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3990. (3436) Q10-4359:

Current phase 2 clinical studies are evaluating the systemic administration of what agent as a possible means of enhancing fracture healing:

1) Recombinant human growth hormone
3) HMG-CoA reductase inhibitors (statins)
2) Recombinant human parathyroid hormone
5) Calcium sulfate
4) Calcium gluconate

A phase 2 (clinical study designed to evaluate product safety) multicenter international study evaluating the effects of teriparatide on distal radius fracture healing is in progress. A total of 105 patients are expected to participate in this study. The primary end point is the time to radiographic healing.

Preclinical evidence suggests that certain lipid-lowering drugs (HMG-CoA reductase inhibitors) may play a role in blocking bone catabolism, and some studies indicate these drugs increase bone mineral density and reduce the risk of fracture; other studies have challenged these findings.

Correct Answer: Recombinant human parathyroid hormone

3991. (3437) Q10-4362:

The prevalence of mesenchymal stem cells in human bone marrow aspirates is:

1) 1,000 per 100,000 nucleated cells
3) Not dependent on patient age
2) 1 per 100,000 nucleated cells
5) Independent of aspiration volume
4) Nearly constant between people of the same age

While bone marrow aspirates contain mesenchymal stem cells, the number and concentration of stem cells is limited. Only 1 per 100,000 nucleated bone marrow cells is a mesenchymal stem cell. The number of stem cells declines with patient age. In addition, variability exists between patients of the same age. Studies have shown that large volume bone marrow aspiration dilutes the number of stem cells with peripheral blood.Correct Answer: 1 per 100,000 nucleated cells

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3992. (3438) Q10-4363:

In a clinical study in which bone marrow concentrate was percutaneously injected into noninfected tibial nonunions, the success of treatment was found to be dependent on:

1) Duration of the nonunion
3) Number and concentration of stem cells implanted
2) Volume of cells injected
5) Associated comorbidities
4) Age of the patient

Recently, Hernigou and colleagues reported on the use of percutaneous autologous marrow grafting in the management of 60 noninfected tibial nonunions. Twelve patients had initially been treated in a cast, while the other 48 were initially open fractures treated with external fixation. The definition of nonunion was failure to heal within 6 months of the injury, with no progressive radiographic healing between 3 and 6 months after injury. They aspirated bone marrow from the iliac crest, filtered it to separate cellular aggregate and fat, and then centrifuged it for 5 minutes, reducing a 300-cc volume of bone marrow aspirate to 50 cc. The concentrated bone marrow aspirate was than percutaneously injected in the nonunion site under fluoroscopy. They reported successful bone union in 53 of the 60 patients and found a correlation between the effectiveness of bone healing and the number of progenitor cells present in the aspirate.

The number and concentration of osteoprogenitor cells present in the bone marrow aspirates of the 7 patients who did not unite was significantly less than the patients in whom union was successfully achieved. All 7 patients who failed to heal were treated with a bone marrow graft that contained less than 1,000 progenitor cells/cm^3 and less than 30,000 progenitor cells.

With the number of patients included in the study, the age, sex, and comorbidities of the patients did not significantly effect the success of treatment (P>.05).

Correct Answer: Number and concentration of stem cells implanted

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3993. (3439) Q10-4364:

The number of stem cells obtained from an iliac crest bone marrow aspiration is influenced by:

1) Total volume of bone marrow obtained
3) Needle diameter used to aspirate bone marrow
2) Volume of each individual aspirate
5) Location selected for aspiration
4) Solution used to store the bone marrow

Muschler and colleagues found that the number of progenitor cells present in bone marrow aspirates was influenced by the volume of the aspirate. When a large volume was aspirated, the osteoprogenitor cells were diluted with peripheral blood. They recommended that the volume aspirated from any one site should not be greater than 2 cc.Correct Answer: Volume of each individual aspirate

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3994. (3440) Q10-4365:

Which of the following statements describes the effect of parathyroid hormone (PTH) (1-34) on bone:

1) PTH (1-34) enhances bone formation when administered intermittently.
3) PTH (1-34) results in bone resorption when administered intermittently.
2) PTH (1-34) enhances bone formation when present continuously.
5) PTH (1-34) impairs osteoclast function when administered intermittently.
4) PTH (1-34) results in decreased osteoblast number and activity when administered intermittently.

While continuous exposure to PTH results in bone resorption, intermittent administration results in bone formation by increasing osteoblast number and activity. The catabolic effects of PTH are related to its activation of osteoclasts, likely through the direct activation of osteoblasts. While continuous exposure to PTH leads to increased osteoclastic activity, intermittent (once daily) exposure to PTH has been shown to preferentially stimulate osteoblast activity over osteoclast activity.Correct Answer: PTH (1-34) enhances bone formation when administered intermittently.

3995. (3469) Q10-4406:

Tricalcium phosphate is a bone graft substitute that can be best described as:

1) Osteogenic
3) Osteoinductive
2) Osteoconductive
5) None of the above
4) Both osteoconductive and osteoinductive

Tricalcium phosphate is an osteoconductive bone graft substitute. Although its hydrophilic nature may allow wicking of blood and bone marrow elements into the internal structure, it does not have any significant osteogenic properties. Osteogenesis refers to the property of autogenous bone grafts or bone marrow that provide live osteoblasts or stem cells that can differentiate into osteocytes. Osteoinduction refers to the process in which specific proteins, such as bone morphogenetic proteins, signal host stem cells to differentiate into bone cells rather than into other types of tissue.

Correct Answer: Osteoconductive

3996. (3487) Q10-4427:

Bone marrow-derived mesenchymal stem cells have the potential to differentiate into which tissue types:

1) Only bone
3) Bone, cartilage, tendon, muscle, and fat
2) Bone and blood cells
5) Bone, cartilage, tendon, muscle, and kidney
4) Bone, cartilage, muscle, and skin

Bone marrow-derived mesenchymal stem cells have the potential to differentiate into bone, cartilage, tendon, muscle, and fat.Correct Answer: Bone, cartilage, tendon, muscle, and fat

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3997. (3490) Q10-4432:

In the treatment of postmenopausal osteoporosis, recombinant human parathyroid hormone teriparatide (Forteo, Eli Lilly) is administered:

1) Weekly, by injection, for less than 2 years
3) Daily, by injection, for less than 2 years
2) Weekly, by injection, for the patientâs entire life
5) Monthly, orally, for less than 2 years
4) Daily, by injection, for the patientâs entire life

Teriparatide is administered as a subcutaneous injection into the thigh or abdominal wall, once daily, at a recommended dosage of 20 µg. Because the safety and efficacy of teriparatide has not been evaluated beyond 2 years of treatment, its use for longer than 2 years is not recommended.

Ibandronate sodium (Boniva, Roche Laboratories), a nitrogen containing biphosphonate, is another class of medication that has been approved for the treatment of postmenopausal osteoporosis. It is available in both oral and injectable forms and may be administered monthly. The mechanism of action is programmed cell death of the osteoclast.

Correct Answer: Daily, by injection, for less than 2 years

3998. (3493) Q10-4435:

The mechanism by which intermittent parathyroid hormone (PTH) administration enhances fracture healing has been suggested to be all of the following except:

1) Stimulation of proliferation and differentiation of osteoprogenitor cells
3) Enhanced osteoclastogenesis during the callus-remodeling phase
2) Increased production of bone matrix protein
5) Accelerating bone mineralization during healing
4) Preferentially stimulating osteoclast activity over osteoblast activity

Nakajima and colleagues also studied the effect of daily PTH on fracture healing in a rat femur fracture model but at a dose of only 10 µg/kg. They found significantly increased bone mineral density and ultimate load to failure at days 28 and 42 after fracture. In addition, they investigated the underlying mechanism by analyzing the number of subperiosteal osteoprogenitor cells, the expression of type 1 collagen, osteonectin, alkaline phosphatase, and osteocalcin mRNA. Their results suggested that the enhanced early callus formation seen in PTH-treated animals was due to the stimulation of proliferation and differentiation of osteoprogenitor cells, increases in the production of bone matrix proteins, and enhanced osteoclastogenesis during the callus-remodeling phase.

While continuous exposure to PTH leads to increased osteoclastic activity, intermittent (once daily) exposure to PTH has been shown to preferentially stimulate osteoblast activity over osteoclast activity.

Correct Answer: Preferentially stimulating osteoclast activity over osteoblast activity

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3999. (3511) Q10-4463:

Distinguishing characteristics of stem cells include that they are undifferentiated cells, can be induced to differentiate into the cell types of specific tissues, and:

1) Can induce differentiated cells to become stem cells
3) Can be obtained only from embryos
2) Are capable of self-replicating for indefinite periods in culture
5) Can only be induced to differentiate into specific cell types when in cell culture
4) Have only a single copy of DNA

Stem cells have three important distinguishing characteristics:

1. Stem cells are undifferentiated cells.
2. Stem cells are capable of self-replicating for indefinite periods in culture.
3. Under certain physiologic or experimental conditions, stem cells can be induced to differentiate into the cell type of specific tissues, such as cartilage or bone.

Stem cells can be obtained from both embryos (embryonic stem cells) and from various adult tissues (adult stem cells).

Correct Answer: Are capable of self-replicating for indefinite periods in culture

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4000. (3670) Q10-7447:

Bioactive glasses are indicated for use in:

1) Subchondral fractures requiring a mechanically strong bone graft substitute
3) All open fractures
2) Open tibial fractures treated with an intramedullary nail
5) Dental and maxillofacial applications only
4) Bone defects that are not intrinsic to the stability of the bony structure

Bioactive glasses are indicated for use in the treatment of bone voids or gaps that are not intrinsic to the stability of the bony structure. These defects may be surgically created bony defects or defects resulting from traumatic bone injury. Bioactive glass products have been used as a bone graft substitute in dentistry since 1993 and were approved for orthopedic use in 2002.Correct Answer: Bone defects that are not intrinsic to the stability of the bony structure

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4001. (3671) Q10-7448:

Bioactive glass bone graft substitute is described as osteostimulative. The term osteostimulation refers to the stimulation of what aspect of bone regeneration following implantation of bioactive glass:

1) Osteoblast proliferation and differentiation
3) Osteocyte proliferation and differentiation
2) Osteoclast proliferation and differentiation
5) Upregulation of bone morphogenetic protein
4) Mesenchymal stem cell proliferation and differentiation

The manufacturer of NovaBone describes bioactive glass as osteostimulative. They define osteostimulation as an active stimulation of osteoblast proliferation and differentiation. After implantation, surface reactions result in the absorption of the device material and concurrent new bone tissue formation. These surface reactions result in an osteostimulative effect.

In vitro studies comparing bioactive glass to other osteoconductive bone graft substitutes have shown increased levels of DNA synthesis and increased levels of the osteoblast markers osteocalcin and alkaline phosphatase.

Correct Answer: Osteoblast proliferation and differentiation

4002. (3672) Q10-7449:

The major component of bioactive glass is:

1) Calcium phosphate
3) Silica
2) Tricalcium phosphate
5) Sodium oxide
4) Calcium oxide

Available bioactive glass beads are composed of silica (45%), calcium oxide (24.5%), disodium oxide (24.5%), and pyrophosphate (6%).Correct Answer: Silica

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4003. (3673) Q10-7450:

Resorption of bioactive glass is characterized as:

1) Extremely slow, with the majority of material remaining for decades
3) Fast, with the majority resorbed within 6 to 12 weeks
2) Slow, with the majority of material remaining for years
5) Occurring by cellular mechanisms only
4) Occurring by chemical dissolution only

Bioactive glass undergoes resorption by a combination of cellular mechanism and chemical dissolution. Upon implantation, the surface area of bioactive glass increases multifold. This provides greater exposure to interstitial fluid and blood resulting in faster resorption. The bioactive glass particles are gradually consumed as they are constantly re-exposed during bone remodeling. Unlike hydroxyapatite, the majority of bioactive glass material is fully resorbed within 6 to 12 weeks after implantation.Correct Answer: Fast, with the majority resorbed within 6 to 12 weeks

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4004. (3674) Q10-7451:

Bone formation that occurs following implantation of bioactive glass occurs in what location:

1) Only along the periphery of the grafted material
3) Throughout the grafted material
2) Only in the center of the grafted material
5) First in the center, gradually increasing toward the periphery over several months
4) First along the periphery of the material, with creeping substitution into the center taking several months

Bone formation in a critical-sized rabbit femoral defect model was greater and occurred faster with bioactive glass than with hydroxyapatite. At 2 weeks, the investigators observed visible bone throughout the bioactive glass material, whereas bone formation was only beginning to form along the margins of the hydroxyapatite.Correct Answer: Throughout the grafted material

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4005. (3675) Q10-7452:

In this approval process, the manufacturer of a bone graft substitute product provides data showing that the new product is substantially equivalent to an already approved legally marketed product commercially distributed before the May 28, 1976, Medical Device Amendment.

1) Premarket application
3) Humanitarian device exemption
2) 510(k) premarket notification
5) Class II device application
4) Class I device application

The majority of bone graft substitute products on the market have been approved through the 510(k) process. In this process, the manufacturer must provide data showing that the new product is substantially equivalent to an already approved legally marketed device, which includes products commercially distributed before the May 28, 1976, Medical Device Amendment. This typically requires only laboratory and animal testing to establish safety and equivalency.Correct Answer: 510(k) premarket notification

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4006. (3676) Q10-7453:

Requirements for a device approved through the humanitarian device exemption (HDE) process include which of the following:

1) The device is intended for a disease affecting fewer than 4000 individuals each year.
3) The device requires approval of the institutional review board where used.
2) The manufacturer is not permitted to make a profit from the device.
5) None of the above.
4) All of the above.

To make new drugs available to select patients, the FDA initiated a humanitarian device exemption (HDE) process in 1996. This process of drug and device approval is âintended to benefit patients by treating a disease that affects fewer than 4000 individuals in the US per year.â To obtain approval the manufacturer must show safety, but does not need to prove efficacy. Additionally, the HDE process requires that the drug or device cannot make a profit for the manufacturer and requires institutional review board approval at the institutions where it is used.Correct Answer: All of the above.

4007. (3677) Q10-7454:

The differences between a class I and class III device include:

1) Class I devices are generally more complex than class III devices.
3) Increased requirements are needed to show safety and efficacy for class III devices.
2) An increased level of risk of injury exists from a class I device.
5) Sufficient information exists to assure safety and effectiveness for class III devices solely through general or special controls.
4) Class III devices are subject to general controls, whereas class I devices are not.

A three-tiered classification was introduced by the Cooper Commission to stratify the risks of medical devices. Medical products classified as class I devices are subject to the least regulatory control. They present minimal potential harm to the user and are often simpler in design than class II or class III devices. Class I devices are subject to âgeneral controls,â which include registration and listing, prohibitions against adulteration and misbranding, notification, repair or replacement or refund, recall, records and reports, and adherence to good manufacturing practices.

Medical products classified as class II devices are those for which general controls alone are insufficient to assure safety and effectiveness, but for which existing methods are available to provide assurances of safety and efficacy. Class II medical devices are subject to general controls as described for class I devices, as well as also to special controls such as postmarket surveillance studies and performance standards.

Class III is the most stringent regulatory category for medical devices. Class III devices are those for which insufficient information exists to assure safety and effectiveness solely through general or special controls. Class III devices present a potential unreasonable risk of illness or injury as a result of their use. Premarket approval is the required process of scientific review to ensure the safety and efficacy of class III devices.

Correct Answer: Increased requirements are needed to show safety and efficacy for class III devices.

4008. (3678) Q10-7455:

An investigational device exemption (IDE):

1) Allows a new device to be used in a clinical study to collect safety and efficacy data required for a premarket application
3) Allows rapid approval of a class I device such as a manual surgical tool associated with a low risk of injury
2) Allows use of a device intended for a disease affecting fewer than 4000 individuals each year
5) Allows rapid approval of a device that is substantially equivalent to an already approved legally marketed device
4) Allows use of a class II device with âspecial controlsâ requiring postmarket surveillance studies

An IDE allows a new device to be used in a clinical study to collect the safety and efficacy data required for a premarket application. A humanitarian device exemption is the process of drug and device approval that is âintended to benefit patients by treating a disease that affects fewer than 4000 individuals in the US per year.â The process in which a manufacturer provides data showing that the new product is substantially equivalent to an already approved legally marketed device is the premarket notification process known as a 510(k).Correct Answer: Allows a new device to be used in a clinical study to collect safety and efficacy data required for a premarket application

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4009. (3679) Q10-7456:

Approval of bone graft substitute products under a 510(k) process requires:

1) A large-scale pivotal human clinical study to prove efficacy
3) Typically only laboratory and animal testing data
2) A preliminary human clinical study to show safety
5) That the product be a human tissue that has only been minimally manipulated
4) No specific testing data because the product is similar to a product already being marketed

Many medical devices receive approval through a less stringent premarket notification process known as a 510(k). In this process, the manufacturer must provide data showing that the new product is substantially equivalent to an already approved legally marketed device, which includes products commercially distributed before the May 28, 1976, Medical Device Amendment. This typically requires only laboratory and animal testing to establish safety and equivalency.Correct Answer: Typically only laboratory and animal testing data

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4010. (3680) Q10-7457:

Prostaglandin E_2 has been shown to be a potent anabolic agent in bone. The anabolic effects on bone are mediated through which receptor(s):

1) EP1
3) EP3
2) EP2
5) EP2 and EP4
4) EP4

The action of PGE2 is mediated by its binding to four cell surface receptor subtypes: EP1, EP2, EP3, and EP4. Activation of EP2 and EP4 receptor subtypes causes an elevation of cellular cAMP levels. In bone, the anabolic action of PGE2 has been linked to elevated cAMP levels, suggesting that the EP2 and EP4 receptor subtypes play a role in bone formation. Bone anabolic activity is mediated by the EP2 and EP4 receptor subtypes, whereas the objectionable side effects are mediated by the EP1 and EP3 receptor subtypes.Correct Answer: EP2 and EP4

4011. (3681) Q10-7458:

In a phase 2 clinical study, the main focus is on what aspect of drug or device evaluation:

1) Safety alone
3) Effectiveness for a specific condition
2) Safety and tolerability
5) Postmarketing surveillance required by the US Food and Drug Administration (FDA)
4) Risk-benefit ratio

Phase 2 clinical studies focus on the effectiveness of the drug to treat the particular condition, whereas phase 1 clinical trials focus on safety and tolerability of the new medication. Phase 2 clinical trials typically involve several hundred patients who have the condition that the experimental medicine is intended to treat. Phase 3 trials test the results of earlier trials in larger populations and gather further information about the effectiveness and safety of the drug or device. This phase usually involves several hundred to several thousand patients enrolled in one or more pivotal clinical trials. Phase 3 trials generally provide the basis for the risk-benefit assessment of a new drug. Phase 4 trials are also called postmarketing studies and are conducted after the drug has been approved by the FDA. These trials allow researchers to collect information about the long-term risks and benefits of the product.Correct Answer: Effectiveness for a specific condition

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4012. (3682) Q10-7459:

The usefulness of prostaglandin E_2 to stimulate bone repair following fracture is limited by its:

1) High cost
3) Lack of anabolic effect on bone repair
2) Side effects that include diarrhea, lethargy, and flushing
5) Inability to maintain local concentration after injection
4) Long-term complications, including development of osteosarcoma

The use of prostaglandins in human clinical studies has been complicated by multiple and severe adverse reactions. Side effects of the use of PGE_2 include diarrhea, lethargy, and flushing. PGE_2 has been shown to have anabolic effects on bone regeneration. Long-term complications have not been reported. The side effects cease following discontinuation of use.

Researchers, hoping to harness the anabolic effect of PGE_2 while avoiding its unpleasant side effects, sought to identify EP2 and EP4 receptor-selective agonists.Correct Answer: Side effects that include diarrhea, lethargy, and flushing

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4013. (3683) Q10-7460:

Preclinical results of the effects of the EP2 receptor-agonist named CP-533,536 have shown:

1) Ability to form bone only in non_critical-sized defect models
3) Anabolic effects only when administered systemically
2) Dose-dependent formation of bone in a critical-sized defect
5) Effectiveness only in lower order animals (rats)
4) Significant bone resorption (osteopenia) following cessation of treatment

Preclinical results of the effects of the EP2 receptor agonist named CP-533,536 have been reported in two different publications.

In one canine study, a critical-sized (1.5-cm) defect was created in the canine ulna and a collagen sponge placed in the defect. Animals received injections of CP-533,536 into the defect site for 3, 7, or 14 days. Radiographic evidence of bony bridging of the critical size defect was seen in 20%, 30%, and 60% of the cases at 10 weeks.

In a second canine study, the same critical-sized defect was created and filled with a PLGH matrix (ATRIGEL delivery system, Atrix Laboratories, Fort Collins, CO). Animals were randomized to receive either 1.0 mL of the matrix alone, 50 mg of CP-533,536 in 1.0 mL of matrix, 10 mg of CP-533,536 in 1.0 mL of matrix, or 10 mg of CP-533,536 in 0.2 mL of matrix. No additional injections were given during the study, with the matrix offering a gradual release of the compound locally. None of the animals treated with the matrix alone healed. In animals treated with 50 mg of CP-533,536, half of the animals showed radiographic bridging of new bone at 24 weeks. Even greater bone healing was seen in the two groups treated with the lower dose of CP-533,536, with 75% of animals showing radiographic bridging at 24 weeks.

Correct Answer: Dose-dependent formation of bone in a critical-sized defect

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4014. (3684) Q10-7461:

Which of the following agents currently in clinical trials offers potential for use in bone repair following fracture:

1) Prostaglandin E_1
3) Prostaglandin E_2 combined with an anticholinergic agent to minimize side effects
2) Prostaglandin E_2
5) Prostaglandin E_2 combined with an EP2 receptor-selective agonist
4) PGE_2 EP2 receptor-selective agonist

The use of prostaglandins in human clinical studies has been complicated by multiple and severe adverse reactions. Side effects of the use of PGE_2 include diarrhea, lethargy, and flushing.

Researchers, hoping to harness the anabolic effect of PGE_2 while avoiding its unpleasant side effects, sought to identify EP2 and EP4 receptor-selective agonists. Researchers at Pfizer Global Research and Development have reported on a highly selective and potent EP2 receptor agonist named CP-533,536. CP-533,536 is currently in phase 2 clinical trials for bone healing.

Correct Answer: PGE_2 EP2 receptor-selective agonist

4015. (3685) Q10-7462:

Platelet-derived growth factor (PDGF) is currently approved in the United States for which of the following indications:

1) Periodontal bone defects
3) Periodontal bone defects and diabetic foot wounds
2) Diabetic lower extremity wounds
5) Open tibial shaft fractures treated with an intramedullary nail
4) As an alternative to autogenous graft for ankle fusion

rhPDGF-BB is currently approved in the United States for use in periodontal bone defects and healing diabetic lower extremity soft tissue wounds due to neuropathy.

Preliminary results of PDGF as an alternative to autogenous bone graft in hindfoot and ankle fusions are promising, and a larger pivotal trial is underway. However, at this time (2008) the product has not been approved for this indication.

Correct Answer: Periodontal bone defects and diabetic foot wounds

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4016. (3686) Q10-7463:

During the initial phase of the wound healing process, platelet-derived growth factor (PDGF) acts to attract and activate which cells:

1) Osteoprogenitor cells
3) Bone morphogenetic protein (BMP)-producing cells
2) Neutrophils and macrophages
5) Platelets
4) Vascular endothelial growth factor (VEGF)-producing cells

Following injury, bone repair is initiated by formation of a blood clot and activation of the coagulation cascade. Platelets accumulate at the fracture site and release their cytokine-laden granules, including PDGF-AB, PDGF-AA, PDGF-BB, and PDGF-CC. These PDGFs initially attract and activate neutrophils and macrophages. These neutrophils and macrophages then provide an ongoing supply of PDGF and other growth factors that play an important role in granulation tissue formation. Later in the wound healing process, PDGFs also exert mitogenic and chemoactactic effects on a variety of mesenhcymal derived cells, including fibroblasts, osteoblasts, and chondrocytes.Correct Answer: Neutrophils and macrophages

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4017. (3687) Q10-7464:

This platelet-derived growth factor (PDGF) is considered the universal isoform because it binds to all known PDGF receptor isotypes. This is the isoform which is being used and studied clinically:

1) rhPDGF-AA
3) rhPDGF-CC
2) rhPDGF-BB
5) rhPDGF-AB
4) rhPDGF-DD

PDGF is a family of proteins that includes five forms: four homodimeric proteins, PDGF-AA, PDGF-BB, PDGF-CC, and PDGF-DD; and one heterodimeric protein, PDGF-AB. PDGF-BB is considered the universal isoform because of its ability to bind to all known PDGF receptor types.Correct Answer: rhPDGF-BB

4018. (3688) Q10-7465:

Local application of platelet-derived growth factor (PDGF) in a collagen carrier to a rabbit tibial osteotomy site resulted in:

1) Decreased callus density and volume
3) Full restoration of mechanical strength (similar to intact bone) 4 weeks after treatment
2) No effect due to the short half-life of PDGF
5) A high rate of wound healing complications
4) Formation of new bone only on the periosteal surface

The effect of exogenous PDGF was studied in a rabbit tibial osteotomy model. Each osteotomy was injected with collagen or collagen containing 80 µg of rhPDGF-BB. Radiographs at 2 and 4 weeks showed an increase in callus density and volume around the PDGF-treated osteotomies. Mechanical testing of the osteotomized and intact tibia was performed at 28 days. The strength of the osteotomy site recovered to the level of the intact bone in animals treated with PDGF, while the control group was statistically weaker than the nonoperated (contralateral) tibia. Histologically, the PDGF-treated tibiae displayed a more robust and advanced state of osteogenic differentiation, both endosteally and periosteally, than the control osteotomies.Correct Answer: Full restoration of mechanical strength (similar to intact bone) 4 weeks after treatment

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4019. (3689) Q10-7466:

Preliminary results of a clinical study of platelet-derived growth factor (PDGF) as an alternative to autogenous bone graft in ankle and hindfoot fusions shows that PDGF:

1) Must be applied daily to the site to achieve a positive effect
3) Has a higher rate of wound complication
2) Must be administered systemically by daily injection to achieve a positive effect
5) Has a similar rate of bony fusion, documented by computed tomography (CT) scan
4) Forms heterotopic bone

The results of pilot study that compared the effectiveness of rhPDGF-BB in a beta-tricalcium phosphate matrix with autogenous bone graft in hindfoot and ankle fusions were presented in 2007. Investigators found equivalent osseous bridging on CT scans at 6 and 12 weeks after surgery, and a > 85% fusion rate for both groups at 24 weeks.

Positive results of this study have lead to a larger pivotal randomized trial that is expected to enroll 396 patients. As of August 8, 2008, 220 patients had been enrolled in this randomized controlled study. Additional presentations on the use of rhPDGF as an alternative to autogenous bone graft have also reported positive results.

Correct Answer: Has a similar rate of bony fusion, documented by computed tomography (CT) scan

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4020. (3690) Q10-7467:

Compared with other recombinant human proteins that are used clinically, recombinant human bone morphogenetic proteins (rhBMPs) are priced:

1) Far lower than other recombinant proteins
3) Higher than most other recombinant proteins
2) Similar to other recombinant proteins
5) There is no comparison, because rhBMP is the only recombinant human protein in clinical use.
4) Significantly higher than other recombinant proteins

The cost of rhBMP is in line with the costs for other commercially available recombinant proteins. For example, the treatment costs for recombinant human erythropoietin is between $6000 and $10,000.Correct Answer: Similar to other recombinant proteins

4021. (4064) Q10-7468:

A thorough economic analysis to evaluate the cost effectiveness of a particular treatment should include which of the following factors:

1) Cost of the product alone
3) Direct and indirect costs
2) Direct costs alone
5) Cost of the product, direct costs, and intangible costs
4) Direct, indirect, and intangible costs

A thorough economic analysis of an individual product or treatment should include direct costs, indirect costs, and intangible costs. Cost of the product is just one portion of the direct costs. Examples of each of these types of costs are provided in the table below:

Table 2. Type of economic costs associated with healthcare delivery

Direct costs		**Indirect Costs**	**Intangible Costs**
Medical	*Nonmedical*		
Surgical interventions	Transportation of patients and families during treatment	Lost productivity (lost wages)	Quality of life (associated with pain, suffering, and grief)
Personnel costs	Lodging of patients and families during treatment	Rehabilitation and skilled nursing care	Quality-adjusted life years
Supplies costs		Disability payments	Psychosocial parameters
Hospitalization costs		Legal costs	
Diagnostic tests		Insurance administration costs	
Medications			
Outpatient visits			
Physical therapy			

Correct Answer: Direct, indirect, and intangible costs

4022. (3691) Q10-7469:

The high cost of recombinant human proteins is primarily due to:

1) The addition of an extremely high profit margin for the manufacturer
3) The high cost of marketing required to convince surgeons to use such an experimental product
2) The addition of an extremely high payment to the patent holder for each individual use
5) The high cost of the carrier with which the product is delivered
4) The high costs required to produce the product

Whereas all of these factors must be considered in setting the price of a recombinant product, the high cost required to produce a recombinant protein is the primary reason for the productâs cost. The cost to design, build, validate, and qualify an industrial size bioreactor for the production of a recombinant protein costs from $400 million to $2 billion. This process can take 3 to 5 years to complete.

In addition to the initial set-up investment, substantial costs are incurred during the production of a recombinant human protein. These expenses include the costs required for equipment sterilization, cell culture production, recovery, purification, viral filtration, in-process testing, and aseptic packaging. The production of a single batch of recombinant protein can take up to 100 highly trained personnel working in continuous shifts for more than a month. Continuous monitoring is required throughout the production process, with more than 200 analytic tests performed during the production run.

Product pricing also needs to account for the costs of the carrier, costs of distribution and marketing, costs for royalties to the inventor/patent holder, costs for ongoing required research, and finally costs to provide a profit to the commercial manufacturer.Correct Answer: The high costs required to produce the product

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4023. (3692) Q10-7470:

Economic analysis of the clinical use of recombinant human bone morphogenetic protein (rhBMP) has shown:

1) Cost effectiveness only for spinal surgery
3) Cost effectiveness only for tibial nonunions
2) Cost effectiveness only for open tibial fractures
5) No evidence of cost effectiveness for any indication
4) Cost effectiveness for spinal surgery, open tibial fractures, and tibial nonunions

Even though there is great variation in economic analysis methods and underlying assumptions, several published reports have suggested that the use of rhBMP is cost effective. These studies include spine surgery, open tibial fractures, and tibial nonunions. Conflicting results may be obtained depending on whether the analysis is done from the viewpoint of the hospital (which may not receive additional compensation for the product use), from the viewpoint of the payor, or from the viewpoint of society as a whole.

All health care costs over a 3-month period were analyzed in a prospective study of 102 patients undergoing lumbar spine fusion randomized to receive rhBMP-2 or iliac crest bone graft. Total payor expenditures for the 3-month perioperative period averaged $33,860 in the rhBMP-2 group compared with $37,337 in the iliac crest bone graft group. Patients treated with rhBMP-2 had a shorter mean operative time and a shorter hospital length of stay. Patients treated with iliac crest bone graft had more frequent and more severe complications, leading to increased costs. Also, a higher rate of inpatient rehabilitation was seen in the iliac crest bone graft group.

Using economic modeling and data from published level I and level II studies, Ziran and colleagues compared the costs of rhBMP use in the management of open tibial fractures. They evaluated the costs of initial acute fracture treatment and the costs for subsequent treatment of nonunion or deep infection. They compared the total societal costs for three different scenarios. In the first scenario, rhBMP was not used during any of the treatments. In the second scenario, rhBMP was used both acutely and during any subsequent procedures for the treatment of nonunion or deep infection. In the third scenario, rhBMP was not used during the acute treatment but was only used during the treatment of nonunion or deep infection. In all three scenarios, the investigators reported little difference in total societal costs. They calculated the aggregate cost of treatment in the first scenario (no use of rhBMP) as $572 million per year. In the second scenario (use of rhBMP at all procedures), the aggregate cost of treatment was reduced slightly to $568 million per year. In the third scenario (use of rhBMP only for secondary nonunion or infection treatment), the aggregate cost of treatment was slightly greater at $575 million per year.

The costs incurred to treat 25 nonunions with rhBMP-7 were examined and compared with prior treatment of those patients. The investigators found that the overall costs of treatment of the procedures in which rhBMP-7 was used were 47% less than the costs of the prior treatment in which rhBMP-7 had not been used. The mean hospital stay and costs of treatment before receiving rhBMP-7 was calculated at 26.8 days and Â£13,844, compared with 7.8 days and Â£7338 for the procedures in which rhBMP-7 was used.Correct Answer: Cost effectiveness for spinal surgery, open tibial fractures, and tibial nonunions

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4024. (3693) Q10-7471:

Commercial production of a recombinant human protein requires:

1) Limited capital investment
3) No specific testing during production
2) Only basic laboratory equipment and a few personnel
5) Continuous monitoring and numerous analytic tests throughout the production process
4) Testing only of the final product to ensure sterility and efficacy

Extensive capital investment is required to produce a recombinant protein for commercial use. The cost to design, build, validate, and qualify an industrial size bioreactor for the production of a recombinant protein costs on average from $400 million to $2 billion. This process can take from 3 to 5 years to complete.

The production of a single batch of recombinant protein can take up to 100 highly trained personnel working in continuous shifts for more than a month. Continuous monitoring is required throughout the production process, with more than 200 analytic tests performed during the production run.Correct Answer: Continuous monitoring and numerous analytic tests throughout the production process

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4025. (3943) Q10-8181:

Which of the following is considered the gold standard of bone graft material:

1) Ceramics
3) Autograft
2) Bone marrow aspirates
5) Bone morphogenetic proteins
4) Blood product isolates

Autograft is still the âgold standardâ bone graft material. Autograft is generally harvested from the iliac crest and provides osteogenic, osteoinductive, and osteoconductive factors. However, autograft is associated with significant morbidity in up to one-third of patients. Additionally, despite the use of autograft, pseudarthrosis remains a concern. For these reasons, materials are being investigated for use as adjuncts or alternatives to this grafting material.Correct Answer: Autograft

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4026. (4019) Q10-8272:

Which of the following is NOT a mechanism of action of physiologic Hyaluronan?

1) Large molecule exclusion properties
3) Desensitization of nociceptive fibers
2) Interaction with cellular signaling such as CD44
5) Decrease in synovial fluid viscosity
4) Alteration of cell adhesion molecules

Hyaluronan has several traits that are thought to contribute to its mechanism of action. It modulates synovial cell and chondrocyte activity, nociceptive pain fibers, cell adhesion, and has large molecule exclusion properties. Hyaluronan also increases viscosity of the synovial fluid, which produces a mechanical benefit for sheer and compressive force distribution.Correct Answer: Decrease in synovial fluid viscosity

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4027. (4020) Q10-8273:

Which of the following is NOT thought to be a maladaptive response of chondrocytes and cartilage to loading in osteoarthritis?

1) Increased production of aggrecanases
3) Shifting of the metabolic balance towards catabolism
2) Shifts in water and proteoglycan content
5) Increased production of matrix metalloproteinases
4) Subchondral sclerosis

In osteoarthritis, chondrocytes subjected to loading shift their metabolism towards catabolic functions, including production of aggrecanases and metalloproteinases. There is also a shift in water and proteoglycan content of cartilage. Subchondral sclerosis is a well-described feature of osteoarthritis, but is thought to be related to changes in bone metabolism.Correct Answer: Subchondral sclerosis

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4028. (4016) Q11-8269:

A 45-year-old heavy laborer presents with 2 years history of pain over the medial aspect his right knee. On examination, the knee has an alignment of 5° varus with a range of motion from 0-105°. He weighs 185 lbs., has no evidence of ligamentous instability and has failed all conservative management. This patient is not a suitable candidate for unicondylar knee replacement because of:

1) Age
3) Knee alignment
2) Occupation
5) Limited preoperative knee flexion
4) Weight

When qualifying a patient for arthroplasty, one must consider the patient's anatomy and his/her goals following surgery. In this case, the patient has all but 1 of the minimum requirements for medial unicondylar knee arthroplasty. Because this patient is a heavy laborer, an unloading osteotomy of the knee may be a more suitable therapeutic choice in order to allow the patient to return to his prior activities following surgery.

Correct Answer:

Occupation

4029. (4017) Q11-8270:

A 67-year-old woman presents with 5 years history of progressive right knee pain. She complains of activity related knee pain over the anterior aspect of the knee. Her past medical history has included history of breast cancer (in remission), 3 prior right knee arthroscopies, and multiple series of viscosupplementation injections to her right knee. She walks with a cane and a slight lurch. Examination of the knee reveals varus alignment of 3°, range of motion from 0° to 115°, and no evidence of instability. Radiographs of her knee reveal moderate narrowing of the medial aspect of the knee joint. The next most appropriate step in her clinical management is:

1) Magnetic resonance imaging of the lumbar spine
3) Consult pain management
2) Bone scan to rule out metastatic disease
5) Radiographs of her pelvis
4) Total knee or unicondylar knee arthroplasty

This woman has presented with a long history of unremitting right knee pain for which she has undergone multiple surgical procedures and injections. While she does have some clinical evidence of knee arthrosis, the severity of her symptoms does not correlate with the severity of her joint disease (radiographs). She walks with a lurch, which may suggest hip disease, a common source of referred pain to the knee. When evaluating a patient, one must take into account all potential causes of pain including adjacent joints.

Correct Answer:

Radiographs of her pelvis

4030. (4018) Q11-8271:

A 62-year-old woman presents to the office with severe tricompartmental arthritis of both her knees. She is morbidly obese (body mass index 50) and is unable to walk or exercise because of her pain. Her left knee is more symptomatic, but she would like to have simultaneous bilateral total knee arthroplasty (TKA). The most appropriate next step in this patient's management is:

1) Left TKA to allow the patient to mobilize and lose weight followed by right TKA at least 3 months apart
3) Referral to a weight loss program including consultation with a bariatric surgeon
2) Simultaneous bilateral knee replacements
5) Viscosupplementation injections
4) Physical therapy

Studies show that super-obese patients (body mass index 50 or greater) have significantly increased complications when undergoing primary unilateral knee replacements. Consequently, simultaneous bilateral TKA would not be a reasonable choice for this patient. Others have also shown that weight following hip and knee replacements do not significantly change unless accompanied by lifestyle changes. In this situation, the safest course for this patient is to postpone surgery and pursue a preoperative weight loss program.

Correct Answer:

Referral to a weight loss program including consultation with a bariatric surgeon

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4031. (4034) Q11-8292:

Which of the following is NOT a characteristic radiographic finding in osteoarthritis?

1) A. Subchondral cyst
3) C. Osteophyte formation
2) B. Osteopenia
5) E. Subchondral sclerosis
4) D. Joint space narrowing

The characteristic radiographic findings in osteoarthritis, which are constant across all joints, include joint space narrowing (often asymmetric), subchondral sclerosis, subchondral cysts, osteophytes and normal bone mineralization. These findings are demonstrated in varying levels of severity depending on the degree of osteoarthritis, and certain joints demonstrate certain findings more frequently. Osteopenia is not a common criterion for osteoarthritis as it is more commonly seen in rheumatoid arthritis. As patients age, there can certainly be both osteopenia and osteoarthritis present, but not necessarily related to each other as in rheumatoid arthritis.Correct Answer: B. Osteopenia

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4032. (4035) Q11-8293:

Which of the following is NOT a characteristic radiographic finding in osteoarthritis?

1) Subchondral cyst
3) Osteophyte formation
2) Osteopenia
5) Subchondral sclerosis
4) Joint space narrowing

The characteristic radiographic findings in osteoarthritis, which are constant across all joints, include joint space narrowing (often asymmetric), subchondral sclerosis, subchondral cysts, osteophytes and normal bone mineralization. These findings are demonstrated in varying levels of severity depending on the degree of osteoarthritis, and certain joints demonstrate certain findings more frequently. Osteopenia is not a common criterion for osteoarthritis as it is more commonly seen in rheumatoid arthritis. As patients age, there can certainly be both osteopenia and osteoarthritis present, but not necessarily related to each other as in rheumatoid arthritis.Correct Answer: Osteopenia

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4033. (232) Q12-342:

Which of the following is primarily responsible for lateral epicondylitis (tennis elbow):

1) Degeneration of the origin of the extensor carpi radialis longus
3) Degeneration of the origin of the extensor carpi ulnaris
2) Degeneration of the origin of the extensor carpi radialis brevis
5) Entrapment of the posterior interosseous nerve
4) Periostitis of the lateral epicondyle

The primary lesion of lateral epicondylitis is fibroangioblastic invasion of the origin of the extensor carpi radialis brevis. Tennis elbow usually responds to nonoperative measures, such as ice, anti-inflammatory medications, and activity modification. Occasionally, steroid injections or surgical debridement becomes necessary.Correct Answer: Degeneration of the origin of the extensor carpi radialis brevis

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4034. (669) Q12-922:

A 42-year-old recreational tennis player has had symptoms of lateral epicondylitis in his dominant elbow for 1 week. Appropriate management should involve what regimen of treatment:

1) Splinting elbow in flexion for 2 weeks
3) Injection of steroid and return to activity
2) Surgical release of the extensor origin at the lateral epicondyle
5) Nonsteroidal anti-inflammatory drugs, ice, and activity modification
4) Heat modalities and wrist extension exercises

With only a 1-week history of lateral epicondylitis of the elbow, the least invasive modalities of treatment must be employed. Nonsteroidal anti-inflammatory drugs, ice, and activity modification will usually improve the symptoms. If the symptoms continue to persist after 6 weeks of treatment, then a more invasive modality is necessary.Correct Answer: Nonsteroidal anti-inflammatory drugs, ice, and activity modification

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4035. (670) Q12-923:

Following an extensive medial release for resistant medial epicondylitis, the most serious iatrogenic complication is:

1) Tardy ulnar nerve palsy
3) Medial elbow instability
2) Weak forearm pronation
5) Posterior interosseous nerve palsy
4) Weak thumb apposition

Medial elbow instability is the most serious complication of an extensive medial release for resistant medial epicondylitis.Correct Answer: Medial elbow instability

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4036. (214) Q13-322:

Dislocation following total hip arthroplasty has been associated with all of the following except:

1) Posterior surgical approach
3) Use of a 22 mm prosthetic femoral head
2) Rheumatoid arthritis
5) Osteonecrosis
4) Impingement of the prosthetic neck on the acetabular component

Dislocation occurs following total hip arthroplasty approximately 1% to 10% of the time. The posterior approach has been associated with a higher dislocation rate. Rheumatoid arthritis, regardless of surgical approach employed, is also a risk factor. Use of a 22 mm femoral head can result in impingement of the prosthetic neck on the acetabular component that can result in dislocation. Patients with osteonecrosis have not been shown to have a higher dislocation rate following total hip arthroplasty.Correct Answer: Osteonecrosis

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4037. (215) Q13-323:

Polyethylene wear debris after total hip arthroplasty is most commonly the result of:

1) Foreign body reaction
3) Wear at the articulation of the femoral head with the polyethylene cup
2) Third body wear
5) Use of a 32-mm prosthetic femoral head
4) Wear at the interface of the metal acetabular shell and the polyethylene liner

Polyethylene wear debris most often occurs at the articulation of the prosthetic femoral head with the polyethylene acetabular cup.Correct Answer: Wear at the articulation of the femoral head with the polyethylene cup

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4038. (216) Q13-324:

Following cemented total hip arthroplasty, polyethylene wear rates average:

1) 0.05 mm per year
3) 0.2 mm per year
2) 0.1 mm per year
5) 0.4 mm per year
4) 0.3 mm per year

Acetabular wear rate following cemented total hip arthroplasty can be expected to be 0.1 mm per year.Correct Answer: 0.1 mm per year

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4039. (217) Q13-325:

Of the following, the main difference between cemented and cementless femoral components in total hip arthroplasty for osteoarthritis is:

1) Higher incidence of thigh pain in cementless components
3) Higher dislocation rate in cementless components
2) Higher infection rate in cemented components
5) Higher incidence of abductor insufficiency in cemented components
4) Higher incidence of groin pain in cementless components

Thigh pain following prolonged activity can occur at the tip of a well-fixed cementless femoral component. This pain is usually not severe and responds to simple measures, such as over-the-counter analgesics and activity modification. Groin pain usually relates to problems with the acetabular component. Rates of infection, dislocation, and abductor insufficiency are similar between the two groups.Correct Answer: Higher incidence of thigh pain in cementless components

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4040. (218) Q13-326:

Total hip arthroplasty in patients with ankylosing spondylitis most often results in which of the following:

1) Aseptic loosening
3) Dislocation
2) Infection
5) Groin pain
4) Heterotopic ossification

Up to 54% of patients with ankylosing spondylitis develop heterotopic ossification following total hip arthroplasty, although the majority of these will be asymptomatic. Prophylaxis in the form of single-dose radiation within 72 hours of surgery should be considered in this patient population.Correct Answer: Heterotopic ossification

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4041. (219) Q13-327:

Prior to performing total hip arthroplasty in an otherwise healthy patient with rheumatoid arthritis and pain isolated to the hip, the following tests should be performed:

1) Knee radiographs
3) Serum C-reactive protein
2) Echocardiogram
5) Flexion and extension cervical spine radiographs
4) Liver function tests

Patients with rheumatoid arthritis are prone to develop cervical instabilities, especially at the C-1 to C-2 level. Up to 50% of rheumatoid patients with cervical instability may be asymptomatic and have a normal physical examination. Radiographic evaluation of the cervical spine is recommended prior to any operative procedure in this patient population to help avoid damaging the cervical spinal cord during endotracheal intubation.Correct Answer: Flexion and extension cervical spine radiographs

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4042. (220) Q13-328:

The most important factor in controlling infection following total hip arthroplasty is the use of:

1) Perioperative antibiotics
3) Individual surgical exhaust systems
2) Laminar flow operating rooms
5) Limited verbal communication during the procedure
4) Ultraviolet operating room lighting

While all of the responses have been associated with lower infection rates, the use of perioperative antibiotics has the greatest impact on minimizing infection.Correct Answer: Perioperative antibiotics

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4043. (221) Q13-329:

Immediately following total hip arthroplasty, a patient is noted to have a femoral nerve palsy of the operated extremity. Appropriate management should include:

1) Observation
3) Immediate electromyogram (EMG)
2) Immediate operative exploration
5) EMG at 2 weeks postoperative if no return of nerve function
4) Delayed operative exploration and nerve grafting in 2 weeks

Nerve injury following total hip arthroplasty is rare. Sciatic nerve injury, the most common, usually results from traction associated with lengthening of the operated extremity. Femoral nerve injury most commonly results from excessive retraction of the psoas muscle. Fortunately, the majority of these palsies resolve spontaneously.Correct Answer: Observation

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4044. (226) Q13-335:

When performing total hip arthroplasty, the femoral component should be positioned in:

1) 10Â° to 20Â° retroversion
3) Neutral version
2) 5Â° to 10Â° retroversion
5) 10Â° to 20Â° anteversion
4) 5Â° to 10Â° anteversion

The femoral component should be positioned in 5Â° to 10Â° of anteversion during total hip arthroplasty.Correct Answer: 5Â° to 10Â° anteversion

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4045. (227) Q13-336:

When performing total hip arthroplasty, the acetabular component should be positioned in:

1) 10Â° anteversion and 45Â° vertical inclination
3) Neutral version and 60Â° vertical inclination
2) 10Â° anteversion and 60Â° vertical inclination
5) 10Â° retroversion and 60Â° vertical inclination
4) 10Â° retroversion and 45Â° vertical inclination

The acetabular component should be placed in 10Â° anteversion and 45Â° vertical inclination during total hip arthroplasty.Correct Answer: 10Â° anteversion and 45Â° vertical inclination

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4046. (4025) Q13-8278:

The most common cause of dislocation after primary total hip arthroplasty is

1) Implant failure
3) Component malposition
2) Infection
5) Neurologic dysfunction
4) Muscle weakness

Although neurologic dysfunction, soft tissue laxity, and loosening due to implant failure or infection contribute to THA instability, component mal-position is the leading cause of dislocation.Correct Answer: Component malposition

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4047. (4026) Q13-8279:

Which of the following is NOT a consequence of acetabular shell malposition:

1) Fibrous ingrowth
3) Increased bearing wear
2) Increased fretting wear
5) Limited range of motion
4) Impingement

Mal-position leads to limited range of motion, impingement, and increased bearing and fretting wear. Fibrous ingrowth is most commonly a consequence of inadequate fixation, and excessive micro-motion.Correct Answer: Fibrous ingrowth

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4048. (4027) Q13-8280:

Excessive anteversion of the acetabular cup may lead to :

1) Cup medialization
3) Leg length discrepancy
2) Posterior implant impingement
5) Dislocation with excessive internal rotation
4) Premature osteolysis

Excessive anteversion leads to anterior dislocation due to posterior component impingement. This most commonly occurs through extension and external rotation of the lower extremity. Excessive anteversion has little or no direct effect on medialization of the cup, leg length disparity, or premature osteolysis.Correct Answer: Posterior implant impingement

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4049. (4028) Q13-8281:

Mechanical guide inaccuracy in cup placement during THA occurs due to:

1) Anatomic soft tissue variance
3) Poor implant fixation
2) Displaced fracture of acetabulum
5) Pelvic positional instability
4) Excessive motion between guide and implant

With adequate exposure, compensation for soft tissue variance is accomplished. Fracture is uncommon, as is gross motion between implant and bone. Provided the guide is used correctly, there is no appreciable motion between it and the implant. Changes in pelvic and patient position, however, will render the mechanical guide inaccurate.Correct Answer: Pelvic positional instability

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4050. (4029) Q13-8282:

Excessive abduction of the acetabular shell may result in all of the following EXCEPT:

1) Edge loading
3) Osteolysis
2) Superior instability
5) Linear polyethylene wear
4) Superior cup migration

Edge loading, superior dislocation or subluxation, linear polyethylene wear and resultant premature osteolysis may all result from an excessively abducted cup. Superior cup migration is most commonly a consequence of a cup with very low abduction.Correct Answer: Superior cup migration

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4051. (4030) Q13-8283:

Bone remodeling and adaptation is driven by all of the following EXCEPT:

1) Non-weightbearing
3) Skeletal loading in excess of physiologic amounts
2) Infection
5) Consistent short habitual loading
4) Local steroid injection

Bone cells are felt to respond to unique loading, short bursts of habitual loading and avoidance of non-weight bearing. Infection does not stimulate normal bone remodeling, nor does local steroid injection.Correct Answer: Consistent short habitual loading

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4052. (4031) Q13-8284:

Which if the following is involved with local signaling in bone remodeling?

1) Hemoglobin A1C
3) Leukocyte esterase
2) Nitric oxide
5) Conjugated bilirubin
4) Alkaline phosphatase

Of those listed, alkaline phosphatase is most directly linked to local factors influencing bone remodeling.Correct Answer: Alkaline phosphatase

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4053. (4032) Q13-8285:

Which of the following variables MOST strongly increases the stiffness of a cylindrical femoral stem?

1) Forged stem
3) Increasing stem length
2) Increasing stem radius
5) Physical therapy
4) Slot in distal stem

Of those variables listed, only an increase in stem radius would significantly increase stem cross-sectional area and hence, stiffness. Increasing length and a slot in the distal tip would decrease stiffness; no significant changes would occur as a result of cast or forging in the stem manufacturing.Correct Answer: Increasing stem radius

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4054. (4033) Q13-8286:

The amount of bone mineral density loss that is necessary to become radiographically apparent is:

1) 10%
3) 30%
2) 20%
5) 50%
4) 40%

Studies have shown that a thirty percent loss in bone mineral density is necessary to consistently become visible on plain film lower extremity radiographs.Correct Answer: 30%

4055. (222) Q14-330:

Which of the following patients would most likely derive the greatest benefit from arthroscopic debridement of the knee:

1) A 65-year-old woman with rheumatoid arthritis
3) A 65-year-old man with generalized knee pain and no mechanical symptoms
2) A 55-year-old man with a varus deformity and an osteoarticular lesion on the weight-bearing surface of the medial femoral condyle
5) A 50-year-old woman with insidious onset of medial knee pain without mechanical symptoms
4) A 55-year-old man with medial knee pain and symptoms of locking

Arthroscopic debridement in the treatment of degenerative conditions of the knee is most successful when symptoms are acute in onset, isolated to one area of the knee, and mechanical in nature. If the mechanical axis of the knee passes through an osteoarticular lesion, little benefit can be expected from arthroscopy. Arthroscopic treatment of the degenerative knee consists of removal of any torn meniscal fragments, loose bodies, and unstable chondral flap tears.Correct Answer: A 55-year-old man with medial knee pain and symptoms of locking

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4056. (223) Q14-331:

Which of the following patients is the best candidate for unicompartmental arthroplasty of the knee:

1) A 60-year-old, 100 kg man with medial knee arthritis and a 10Â° fixed varus deformity
3) A 50-year-old, 80 kg manual laborer with medial knee arthritis
2) A 70-year-old, 70 kg man with medial knee arthritis and a 130Â° arc of motion
5) A 60-year-old, 50 kg woman with lateral knee arthritis and a 10Â° fixed valgus deformity
4) A 50-year-old woman with rheumatoid arthritis and medial joint space narrowing

Results of unicompartmental arthroplasty in the treatment of knee arthritis are highly dependent upon proper patient selection. The ideal candidate for unicompartmental arthroplasty is over the age of 60, of average weight, low demand, has good range of motion, and does not have a significant fixed valgus or varus deformity.Correct Answer: A 70-year-old, 70 kg man with medial knee arthritis and a 130Â° arc of motion

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4057. (224) Q14-333:

Which of the following describes the desired alignment of the lower extremity following total knee arthroplasty:

1) Mechanical axis of 7Â° of valgus
3) Anatomic axis of 7Â° of valgus
2) Mechanical axis of 7Â° of varus
5) Anatomic axis of 7Â° of varus
4) Neutral anatomic axis

The anatomic axis is the angle of intersection of the shaft of the femur with the shaft of the tibia. The mechanical axis is the angle of intersection of a line connecting the center of the femoral head to the center of the tibial plateau, and a line connecting the center of the tibial plateau to the center of the ankle. Desired alignment following total knee arthroplasty is neutral mechanical axis or an anatomic axis of 5Â° to 7Â° of valgus.Correct Answer: Anatomic axis of 7Â° of valgus

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4058. (225) Q14-334:

After appropriate balancing of soft tissues during total knee arthroplasty, the knee is loose in flexion and tight in extension. Appropriate management at this time would be:

1) Resection of more of the posterior femoral condyles
3) Resection of more of the proximal tibia
2) Resection of more of the distal femur
5) Insertion of a thinner polyethylene
4) Hamstring and gastroc-soleus lengthening

Balancing of the flexion/extension gaps in total knee arthroplasty should first be done by correcting the soft tissues. If the knee remains tight in flexion and extension after insertion of an 8-mm polyethylene spacer, more proximal tibia should be resected to increase both the flexion and extension gaps. If the knee is tight only in extension, more distal femur should be resected to increase only the extension gap. If the knee is tight only in flexion, a larger posterior slope can be cut into the tibia.Correct Answer: Resection of more of the distal femur

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4059. (228) Q14-337:

Following total knee arthroplasty, how much knee flexion is required to arise from a chair?

1) 60Â°
3) 90Â°
2) 75Â°
5) 120Â°
4) 105Â°

At least 90Â° of knee flexion is required to easily arise form a chair.Correct Answer: 90Â°

4060. (4038) Q14-338:

A posterior cruciate substituting total knee prosthesis should be strongly considered in all of the following patients except:

1) A patient with a prior posterior cruciate ligament tear
3) A patient with rheumatoid arthritis
2) A patient with a 15Â° fixed varus deformity
5) A patient with a 10Â° fixed valgus deformity
4) A patient with a prior patellectomy

History of rheumatoid arthritis, prior patellectomy, fixed valgus deformity greater than or equal to 15Â°, or prior posterior knee instability are relative indications for use of a posterior cruciate substituting prosthesis in total knee arthroplasty. Outside of these settings, neither posterior cruciate preserving nor substituting designs has any definitive advantage over each other.Correct Answer: A patient with a 10Â° fixed valgus deformity

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4061. (229) Q14-339:

All of the following are factors associated with increased polyethylene wear following total knee arthroplasty except:

1) Gamma sterilization in air
3) More conforming tibial articulating surface
2) Thin polyethylene thickness
5) Male patient gender
4) Younger patient age

More conformity between the femoral and tibial components results in less polyethylene wear, although at a cost of a lesser arc of motion. Ethylene oxide sterilization is preferred to gamma sterilization in air because of effects on wear characteristics. Younger patient age, male gender, and increased patient weight have all been shown to increase polyethylene wear following total knee arthroplasty.Correct Answer: More conforming tibial articulating surface

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4062. (525) Q16-727:

When performing shoulder arthroplasty for rheumatoid arthritis, the following type of component should be employed:

1) Standard length, cemented humeral stem without a cement restrictor
3) Standard length, press-fit humeral stem
2) Standard length, cemented humeral stem with a cement restrictor
5) Long, cemented humeral stem without a cement restrictor
4) Long, press-fit humeral stem

When performing proximal humeral arthroplasty in patients with rheumatoid arthritis, the bone is frequently osteoporotic. Press-fit humeral stems have been associated with a high incidence of loosening. Unless an intraoperative fracture is encountered, long-stem prostheses are not necessary. A cement restrictor is used in this patient population because of the possible need of elbow arthroplasty in the future.Correct Answer: Standard length, cemented humeral stem with a cement restrictor

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4063. (526) Q16-728:

An absolute contraindication to glenoid resurfacing when performing shoulder arthroplasty is:

1) Patient is less than or equal to 50 years of age
3) Insufficient bone stock
2) Presence of a small supraspinatus tear
5) Presence of an inflammatory arthropathy
4) Presence of osteonecrosis of the humeral head

Sufficient bone stock must be present to implant a glenoid component when performing shoulder arthroplasty. While hemiarthroplasty in a young patient without arthritic changes of the glenoid can be considered, age is not considered an absolute contraindication to glenoid resurfacing. While the presence of a large rotator cuff tear represents a contraindication to glenoid resurfacing because of the ârocking horseâ effect, which results in glenoid loosening, a small reparable rotator cuff tear does not prohibit resurfacing. Glenoid resurfacing is not contraindicated in osteonecrosis or rheumatoid arthritis provided there is a competent rotator cuff.Correct Answer: Insufficient bone stock

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4064. (527) Q16-729:

Function following shoulder arthroplasty for rheumatoid arthritis is most dependent upon:

1) The preoperative status of the rotator cuff
3) Surgeon experience
2) Glenoid resurfacing
5) Use of a large head monopolar humeral component
4) Use of a bipolar humeral component

While pain relief following shoulder arthroplasty for rheumatoid arthritis is favorable, postoperative function is less predictable. The most important factor in predicting postoperative function is preoperative function, specifically as it relates to the status of the rotator cuff musculature.Correct Answer: The preoperative status of the rotator cuff

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4065. (528) Q16-730:

Pain relief is more reliable in the treatment of rheumatoid arthritis of the shoulder using:

1) Synovectomy
3) Resection arthroplasty
2) Hemiarthroplasty
5) Total shoulder arthroplasty
4) Bipolar arthroplasty

Total shoulder arthroplasty most reliably relieves pain in patients with advanced rheumatoid arthritis of the shoulder. However, glenoid resurfacing should only be used in these patients in the presence of a competent rotator cuff and sufficient glenoid bone stock.Correct Answer: Total shoulder arthroplasty

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4066. (529) Q16-731:

All of the following are risk factors for development of osteonecrosis of the humeral head except:

1) Use of fluoroquinolone antibiotics
3) Ethanol abuse
2) Sickle cell anemia
5) Paraplegia
4) Gaucher disease

Although fluoroquinolone antibiotics have been implicated as a risk factor for tendon ruptures, they have not been linked to the development of osteonecrosis. Paraplegia has been linked to the development of osteonecrosis of the humeral head, presumably from increased load in the weight-bearing dome of the humeral head.Correct Answer: Use of fluoroquinolone antibiotics

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4067. (530) Q16-732:

After prosthetic replacement of the humeral head following a comminuted proximal humerus fracture, a poor outcome is most commonly associated with:

1) Not resurfacing the glenoid
3) Migration of the lesser tuberosity
2) Migration of the greater tuberosity
5) Presence of pre-existing glenoid arthritis
4) Excessive prosthetic anteversion

The factor most commonly associated with a poor result following prosthetic replacement of the humeral head following a fracture is migration of the greater tuberosity. The glenoid is generally not resurfaced. Excessive prosthetic retroversion is more closely associated with a poor result than excessive anteversion.Correct Answer: Migration of the greater tuberosity

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4068. (531) Q16-733:

"Tuberosity escape" following humeral arthroplasty for a comminuted fracture of the proximal humerus is most commonly related to:

1) A humeral component that is too proud and retroverted
3) A humeral component that is too proud and anteverted
2) A humeral component that is too low and anteverted
5) A humeral component that is too low and has appropriate version
4) A humeral component that is too low and retroverted

Migration of the greater tuberosity is most commonly related to a prosthesis that has been placed too proud and in excessive retroversion.Correct Answer: A humeral component that is too proud and retroverted

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4069. (532) Q16-734:

Positioning of the humeral stem at the time of total shoulder arthroplasty should allow congruent articulation with the glenoid component. Congruent articulation occurs in most shoulders with a humeral stem positioned in:

1) Neutral version
3) 20Â° to 30Â° of retroversion
2) 10Â° to 20Â° of retroversion
5) 20Â° to 30Â° of anteversion
4) 10Â° to 20Â° of anteversion

It is important to place the humeral stem in appropriate version to "mate" with the glenoid component. This is most often represented by 20Â° to 30Â° of humeral retroversion.Correct Answer: 20Â° to 30Â° of retroversion

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